RMIT UNIVERSITY

TIRTA NIRMAYA

Designing a Malay User-interface using indigenous Jawi script

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Noor Hasbi Bin Yusoff

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ABSTRACT

My project (Tirta Nirmaya) is a design prototype of a mobile application interface based on Jawi script, an ancient Malay indigenous script. The design prototype is the result of my exploration of techniques of designing user interfaces based on Jawi script. It is a culturally important development, because Jawi typography is a communicative and literary tool in the Malay culture, and Jawi has been the intellectual and political conveyor in the history of the Malays. The prototype in Tirta Nirmaya uses poetry as content because in the Malay culture, it is a literary genre that is used to narrate history, mythology, proverb, riddles and folk romances.

To complete my research project, I needed to know more about two fields within Human-Computer Interaction – firstly, the development of a sustainable user interface. Secondly, I need to understand how my research can make a novel contribution to the epistemology of user interface design and cultural heritage content among globalised computer users

My project involved analysis of the usefulness of Aaron Marcus' specific guidelines for the critical aspects of globalisation in the user-interface design process. Marcus' design process guidelines apply to the following functions: user demographics, technology, metaphors, mental models, navigation, interaction and appearance. Marcus and Gould (2012) assert that "global product distribution requires a strategy and tactics for the design process that infuse international and cultural requirements" (p. 343). To create such a strategy, I applied Marcus' design process guidelines to two case studies. The first case study is the interface of a Malaysian government website (the Jawi Portal). The second case study relates to an interface I have designed for my research project, in order to gain an

understanding of the usefulness of the theory and subsequent user-interface design technique for the Malay user.

Locating a definitive design guideline for developing a user-interface for the Malay user proved difficult, for several reasons. Firstly, many academics have described the Malay culture as a diverse and complex one within a multicultural society. Artistically, the identity of the Malay culture is infused by other cultures, especially through social and intellectual traditions. While Chinese and Indian Malaysians use their indigenous typography as part of their user-interface, Malays use Latin typography. As a designer, how could I account for this diversity? Aaron Marcus, Ben Shneiderman and Catherine Plaisant recommend establishing design guidelines for multiple language and cultures.

Secondly, the dwindling use of Jawi since 2001 among the youth in Malaysia and Brunei complicated the design of the user-interface. Leading cultural academics contend that Jawi is a crucial component of identity for the Malay people, and that the use of Jawi should be sustained by eternalising it in the public domain, which includes the development and use of software applications. Through the development of an application that utilises Jawi script, my aim is to encourage and cultivate the sustainable practice of this aspect of heritage within the multicultural society of Malaysia.

CHAPTER 1: INTRODUCTION

1.1 Description of Project

My research project, entitled Tirta Nirmaya examines Aaron Marcus' (2006) guidelines for design of the user-interface design process. Marcus' guidelines focus on aspects of globalisation and apply to the following functions: user demographics, technology, metaphors, mental models, navigation, interaction and appearance. The guidelines are categorically analysed and applied in my research project. I operationalize the theory by applying Marcus' guidelines to a case study. I later apply them to a discussion of the design process of my prototype. Therefore, we may gain insight into the usefulness of the theory and technique that can be observed in my design prototype.

My research project is the creation of a design prototype for a mobile application concept. The design prototype will include the logo, user interface elements (menu buttons, type, colours and layout), a wireframe mock-up and the design prototype. Hennipman, Oppelaar, van der Veer and Bongers (2008) recommend that the " typical design process of an interactive system starts with idea gathering and requirements engineering" (p. 2). Hennipman et al. (2008) further explain that this process enables designers to "visualise the ideas with sketching and other simple modelling techniques" (p. 2). Thus, in Tirta Nirmaya, the visualisation of the mobile interface is based on the Jawi script and modelled within UXPin software environment.

The design prototype for Tirta Nirmaya utilises the adaptive and flexible "mobile first" approach to design that focuses on the constraints and capabilities of mobile devices. Ethan Marcotte and Luke Wroblewski assert that user-interfaces need to be flexible and adaptive to different set of constraints and capabilities (Marcotte, 2011; Wroblewski, 2011).

My project is designed specifically for Malaysian users of the Malay language background. In the first quarter of 2014, Malaysians between the age of 20–29 and who understand the Malay language were the most active mobile internet users in Malaysia (Malaysian Communications and Multimedia Commission, 2015). Within this target user group, my design approach focuses on layout and user-interface components to accommodate the target user group. I aim to make the user-interface, layout and content of the application prototype familiar and accessible to the Malay user. The intended goal here is to produce a functional and useable design prototype of a mobile application that will eventually improve and preserve the literacy of Malay users in using the Jawi script to access the Malay language.

The design and development workflow for Tirta Nirmaya involved sketching, wireframes (Fig 1.1), mock-up and development. The design process included the creative rendering of typographic elements into user-interface elements from paper sketches, later digitised using Adobe Illustrator and Photoshop. Using Balsamiq Mockups for Desktop application software (and later changing to UXPin software environment), the user-interface elements together with the Jawi textual contents were then placed on a sequential storyboard to establish an accessible layout structure. The final product is a design prototype that indicates user interaction.

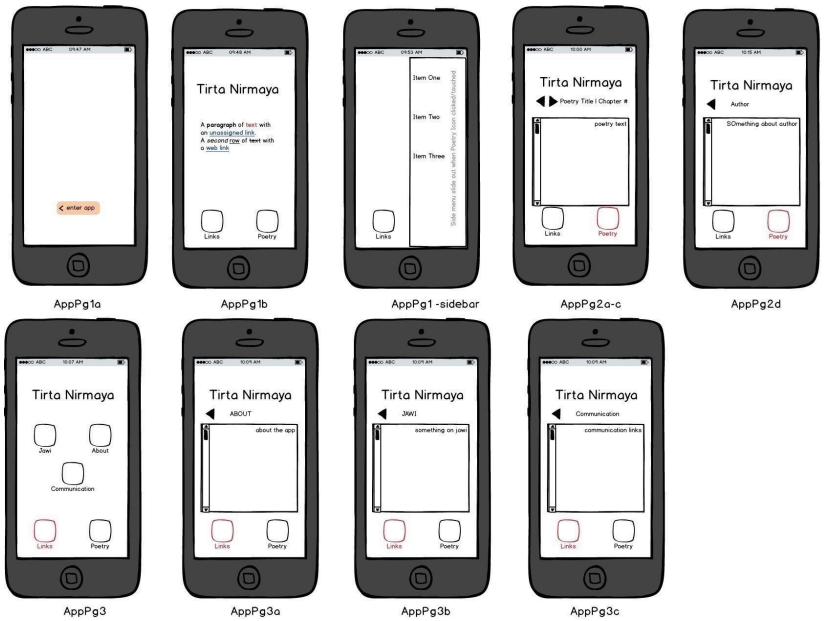

Fig 1.1. Wireframe for Tirta Nirmaya developed using Balsamic Mockups for Desktop

1.2 Background to the Research

Tirta Nirmaya is a design prototype of a mobile application concept. The design prototype was the result of my exploration of the techniques necessary for designing a user-interface. As a user-interface designer, I faced several problems locating a definitive design guideline for the development of a user-interface for Malay users. My aim is to present Malay cultural content, reflecting the uniqueness of the Malay identity through its most valuable yet declining asset (as mentioned by academics such as Annabel Gallop (1994), Maskuri Yaacob (2001), Timothy Barnard (2010) and Zakaria Stapa (2014)), the Jawi script (Fig 1.2). To achieve this goal, I set out to design the user-interface as well as textual content for the prototype application based on scholarly researched data. The text is a major poetic work by Qais Al Muhib in the Jawi script of the Malay language.

Fig 1.2 The manuscript of “Syair berang-berang”, a Malay poetry by Hamzah Fansuri written during the late 18th century by Kapitan To Sih (Gallop & Arps, 1991, p. 66-67)

Tirta Nirmaya is designed for Malay users to experience cultural content through consistent and regular use. The design challenge is to provide an interface for the Jawi script for small screens. Further, the cultural challenge of the project is to prevent the dwindling use of Jawi script. In addressing these technical and cultural constraints, this design project may have big implications for Malay users by providing them an adaptive and usable interface.

As noted already, Jawi has been an intellectual and political conveyor in the history of the Malays (Yatim, 2006). I am prototyping poetry as content in this application because, in the Malay culture, poetry is a literary genre that is used to narrate its history, mythology, proverbs, riddles and folk romances (Al Attas, 1978; Hamid, 1983). My project, Tirta Nirmaya, attempts to rekindle cultural spirit among Malay users with a representation of poetry in Jawi for a mobile application.

Stapa (2014) and Barnard (2010) acknowledge that Jawi script has been an important cultural component that reflects the identity of the Malays. Sariyan (2014) suggests that "perpetuating" Jawi in software applications may sustain its uses and provide a sense of identity for the Malays. Therefore, designing a user-interface based on Jawi script could help sustain the Jawi literacy and cultural identity of the Malays.

Additionally, the dwindling use of Jawi since 2001 among the youth in Malaysia complicates the design of the user-interface and content in the Jawi script. Yaacob (2001) and Yatim (2006), and the Crown Prince of Brunei, Prince 'Abdul Malik (2012), warn that the lack of Jawi presence in software application and online may cause its use to decline further than it already has. Despite the esteemed position of Jawi script among Malays throughout history, almost all of the Malay-based content in online and mobile applications use Latin

(or Romanised) typography instead. This was the biggest design problem. In contrast, Chinese and Indian Malaysians use their indigenous typography – simplified Chinese (Zhongyi Songti) and Tamil (Sai) typefaces respectively - to visually enhance their online literacy and cultural identity**.** The challenge for this project is to design an as-yet non-existent typographical font to manage interface presentation of the Jawi script.

1.3 Rationale

This research project is important because the design prototype may provide user-interface designers with a framework of useful design process guidelines in the Malaysian context. Based on Aaron Marcus' (2006) specific framework on user-interface design and processes, these guidelines may be useful when creating software and online applications for Malay users, and for any users who wish to read the Jawi script. The project also has wider implications for the understanding of globalised media, particularly in relation to specialized language and culture groups.

My critical analysis of the research project aims to support the sustainable development of literacy and cultural identity relating to the Malay language using the Jawi script on the internet. Malay users have a right to expect this outcome; the United Nations' Universal Declaration of Human Rights emphasises

> *desire and commitment to build a people-centred, inclusive and development-oriented Information Society, where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life, premised on the purposes and principles of the Charter*

of the United Nations and respecting fully and upholding the Universal Declaration of Human Rights. (Shneiderman & Plaisant, 2010, p. 98)

In accordance with this declaration, online applications should be designed to be "accessible to all, affordable, adapted to local needs in languages and culture" and to "support sustainable development" (Shneiderman & Plaisant, 2010, p. 29). This research project may help to sustain the literacy and cultural identity of the 300 million speakers of the Malay language, especially the 60% who use the Internet (Kozok, 2012; Malaysian Communications and Multimedia Commission, 2014; Wu, 2014).

According to the Malaysian Communications and Multimedia Commission (2015), in 2014, 86.3% of the Malaysian population were mobile phone users. Malaysia leads its Southeast Asian neighbours in mobile internet usage with a 140% penetration rate (Teller, 2014). These statistics indicate that Malaysians are very comfortable in accessing applications and websites from their mobile phones; therefore, a "mobile first" design approach is sensible. The techniques include using Jawi script as a user-interface component and content for the Malay user. This is important because Jawi script is an important communicative and literary tool in the Malay culture (Al Attas, 1976; Cooper, 1982; Gallop, 1994; McCabe, 2011; Milner, 2008; Simpson, 2007; Yatim, 2006). The design of my research project, Tirta Nirmaya, will be useful in subsequent development of user-interface products for Malay users.

The dwindling use of Jawi script in application software and websites has already triggered practical design solutions for Malay users. According to Aaron Marcus and Emilie Gould (2012), with "the rise of the internet and application-oriented websites and mobile

devices, the challenge of designing good user-interfaces has become an immediate, practical matter, rather than a theoretical issue" (p. 343). Marcus and Gould insist that all design efforts require understanding of user demographics, experience, education and organisational roles (Marcus & Gould, 2012). Shneiderman and Plaisant substantiate Marcus' and Gould's assertion by highlighting the fact that designers are struggling to establish guidelines for designing for multiple languages and cultures (Shneiderman & Plaisant, 2010).

In view of the struggle that designers face, it is beneficial for designers to have specific guidelines that address critical aspects of globalisation in the user-interface design process. From the perspective of my own project, one of the major critical aspects is the increasing number of Malay users on the internet. As mentioned earlier, there are more than 300 million speakers of the Malay language in Southeast Asia (Kozok, 2012, Wu, 2014). In Malaysia, the official language is Malay and 71.2% of the population are Malays. Therefore, Dr Awang Sariyan (2014) suggest the incorporation of the Jawi script as the visual manifestation of the Malay language may encourage designers to develop specific design guidelines.

In Malaysia, as previously mentioned, use of the Jawi script for information and communication is dwindling (Malik, 2012; McCabe, 2011; Yaacob et al., 2001; Yatim, 2012). For instance, in 2012, the only full Jawi interface and content website (www.k-jawi.org.my) went offline. To improve the use and acceptance of the Jawi script on the Internet, the Malaysian government has launched several educational initiatives and the Brunei King gave a royal decree on the sustainable use of Jawi. Governmental and royal intervention suggests

it is worthwhile to explore the specific guidelines on the critical aspects for globalisation in the user-interface design process.

The design guidelines produced as part of this research project should help to sustain the cultural identity of Malays. As Stapa (2014) says, “Jawi is a treasure that lends identity to the Malay people” (Young Generation Needs To Master Jawi, para. 2). In Malaysia, the ethnic Chinese and Indian minority populations maintain their cultural identity online through the use of Chinese and Tamil typographies (Fig 1.3a and 1.3b). In contrast, the Malay language online is exclusively written using the Romanised alphabet rather than the Jawi script (Fig 1.3c). Therefore, practitioners designing for Malay users in Jawi script would benefit from specific guidelines that address critical aspects of localisation (within a globalised context) in the user-interface design process.

Fig 1.3a Homepage of Guang Ming, a Chinese daily newspaper in Malaysia. Retrieved from http://www.guangming.com.my

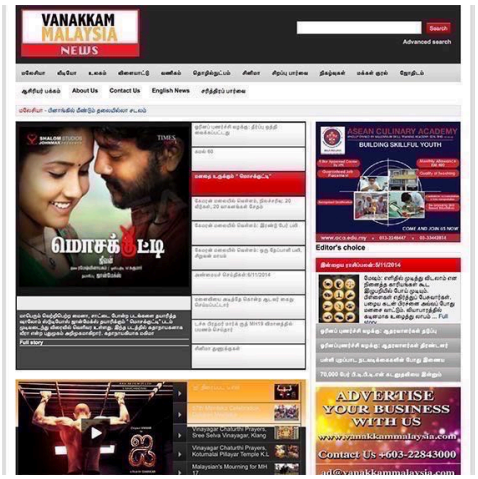

Fig 1.3b Homepage of Vanakkam Malaysia, online daily Tamil news site in Malaysia.

Retrieved from http://www.vanakkammalaysia.com

Fig 1.3c Homepage of Berita Harian, online daily Malay news site in Malaysia. Retrieved from http://www.bharian.com.my

A Malay cultural academic, Professor Mashkuri Yaacob, suggests that information technology and the web can increase use and acceptance of the Jawi Script (Yaacob et al., 2001). Yaacob's suggestion is echoed by Malaysia's Information, Communications and Culture Minister, Datuk Seri Dr Rais Yatim, Brunei's Royal Highness Prince 'Abdul Malik, and a South Korean academic, Prof Dr Kang Kyoung Seok of Busan University (New Straits Times,

2012; Radio Television Brunei News, 2012; The Brunei Times, 2012). Therefore, specific guidelines about the critical aspects of localisation (in a globalised context) in the user-interface design process are essential to sustain and revive the literacy, as well as cultural identity, of Malay users with respect to the Jawi script.

1.4 Methodology

My research project focuses on the study of human-computer interaction and the sustainable development of a user-interface. My research also contributes to the epistemology of user-interface design and cultural content among localised computer users. The outcome of my research facilitates an understanding of the knowledge that is required to design a user-interface specifically for Malay users. Therefore, my research complements Aaron Marcus' specific guidelines on the critical aspects of globalisation in the user-interface design process by exploring the idea generation and techniques involved in designing a user-interface that presents a Malay cultural content.

The sustainable development of a user-interface design for the Malay user was my central focus in this research. Marcus' call to design for the intended user has been the catalyst for my seeking to understand aspects of sustainable development of user-interface design. I aim to delve deeper into the main factors that facilitate user-interface design for a specific locale or user group. The processes and outcome of my research shed some light as to whether all or some of Marcus' recommendations are useful (in the context of the knowledge within Human Computer Interaction) to have sustainable development of user-interface design for the Malay user.

The design prototype proposed here will allow designers to adapt to new technology and evolving user preference. Hennipman et al. (2008) suggest that design prototypes have

evaluative characteristics which are very much dependent on the users' requirements. As users' familiarity with technology grows exponentially with time, a design guideline can streamline evaluation of the design processes.

In view of the diversity and complexity of the Malay culture, I applied Aaron Marcus's seven specific guidelines on the critical aspects of globalisation in the user-interface design process. Following Marcus's guidelines generated a consistent user-interface and satisfying user experience (Marcus, 1995, 1998, 2005, 2011; Marcus & Gould, 2012) and an understanding of the design process of a user-interface for Malay users based on the Jawi script. Marcus' guidelines served as the design framework that was analysed in the case study presented in Chapter 4 and for my project in Chapter 5.

The decision-making process in developing the sequential storyboard relied on a combination of relevant data from cultural models collected by Gould, Zakaria and Yusoff (2000). Nancy Hoft (1996) explains that reusable cultural data allows researchers to qualitatively understand their target user groups. An example of a useful set of data about cultural dimensions and differences is that collected by Gould and colleagues while studying the impact of culture in the design of websites for Malaysia (Gould et al., 2000). I also examine Marcus' explanation of Hofstede's Cultural Dimensions (in Chapter 3) and analyse the data collected by Gould and colleagues using case studies (in Chapter 4); the design ideas and interaction sequence in Tirta Nirmaya are justified in Chapter 5.

My research focuses on Aaron Marcus' inquiry into human-computer interaction (HCI). Jawi script is the core conceptual component in the design of the website interface. Marcus' seven guidelines on the critical aspects of globalisation in the user-interface design process are described in Chapter 3, analysed in Chapter 4 and applied to my project in Chapter 5. The resulting framework informs a set of process guidelines for conceptualising a

user-interface and content based on Jawi script for Malay users. These guidelines will be useful to others in the field such as user-interface designers who create user-interfaces for governments and cultural organisations providing services and content for the Malay user.

As already stated, I focus on Aaron Marcus' specific guidelines that address the critical aspects of globalisation in the user-interface design process (Marcus, 1995, 1998, 2006). The theories, methods, principles and strategies that I examined formed a conceptual foundation for the successful development of my project. The research questions that guided the process are listed below.

1.4.1 Research Question One

According to Aaron Marcus, what factors are important in designing a localised user-interface?

To address this question, I examined Marcus' chapter, "Globalization, localization and Cross-cultural user-interface design" in the Human-Computer Interaction Handbook. In particular, I focused on the specific guidelines on the critical aspects of globalisation in the user-interface design process: user demographics, technology, metaphors, mental models, navigation, interaction and appearance. Marcus's explanation of Hofstede's dimension of culture and data enhanced my understanding of the specific guidelines. This examination of Marcus' specific guidelines provided the conceptual framework for my research.

To situate Marcus's theory within the broader field of Human-Computer Interaction, I reviewed literature related to Human-Computer Interaction and globalisation. I also reviewed scholarship on the Malay people and culture. With respect to Human-Computer Interaction and globalisation I analysed Nielsen's theory of international usability,

Shneiderman's interpretation of the cultural centred design processes, Barber and Badre's writing about culturability, Ethan Marcotte's ideas about responsive web design and Luke Wroblewski's approach to mobile first design. To understand Malay users, I reviewed Ahmad (1986) translation of Tun Sri Lanang's work *Sulalatus Salatin* (The Malay Annals), Anthony Milner's and several other academics' theories on the influence of religion within Malay culture, Annabel Gallop's work - Golden Letters, and Gary Bunt's writing about the Cyber Islamic Environment. These theories and practical approaches complement Marcus' guidelines. The theories from the review of literature (Chapter 2) and the subsequent conceptual framework (Chapter 3) were applied to the next research question.

1.4.2 Research Question Two

In analysing the case studies, how can Aaron Marcus's theories be effectively implemented in a localised user-interface?

I sought to understand the Malays and the sustainable development of their literacy and cultural identity through designing a prototype for a mobile application. In order to understand the practical application of localised user-interface design principles, I analysed several case studies.

To address this research query, I applied Marcus' seven specific guidelines on the critical aspects of globalisation in the user-interface design process to Malaysia's Ministry of Information, Communications and Culture's Jawi-based user-interface design, the Jawi Portal. I also applied Marcus's guidelines to Qatar's localised user-interface, ictQatar responsive design. The analysis of Marcus's guidelines within these case studies (Chapter 4) helped me to formulate a design methodology and approach for my project, Tirta Nirmaya.

1.4.3 Research Question Three

How useful or not are the theory and technique observed in this study to the development of my project?

In Chapter 5, I discuss how Marcus' seven specific guidelines are relevant and useful to the overall design and development of my project. I also discuss the usefulness to my project of techniques such as those observed in the Jawi Portal and ictQatar.

The case study sheds light on whether Marcus's seven specific guidelines are useful for the design of a prototype with localised user-interfaces based on the Jawi script. I discuss experimentation with typography and user-interface design methodologies through paper sketches and digital manipulation. I conclude with some process guidelines for the design of the user-interface and content based on Jawi script, as well as the design of a practical framework for user-interfaces to sustain the literacy and cultural identity of the Malay language in the Jawi script.

Finally, I reflect on the design techniques, methodology and approach to the project. I draw conclusions related to the project's research questions (Chapter 6) and consider improvements that could be made to the design framework. I then offer some suggestions about the possible direction of future research and development methodology in the field of human-computer interaction, specifically with respect to guidelines on the critical aspects of globalisation in the user-interface design process.

CHAPTER 2: REVIEW OF LITERATURE

In this chapter, I provide an extensive overview of user-interface design guidelines and components for applications, specifically web-enabled devices. I also highlight the fusion between Islam and the Malay culture through Jawi calligraphic writing. According to the United Nations' Universal Declaration of Human Rights, applications should be accessible to all and support sustainable development (Sneiderman & Plaisant, 2010). Yaacob et al. (2001) states that use of Jawi script is dwindling and must be revived. The cultural heritage of Jawi writing can be a tool for learning and communication (Jalal & Isa, 2005). Therefore there is a need to develop sustainable ideation and design methodology of user-interfaces for Malays that promote use of Jawi script.

The development of specific user-interface design guidelines is important given the ever-increasing and diversified internet usage. The Malay culture may need some kind of localisation of the user-interface. It is then up to designers and developers alike to create website user-interfaces using the available guidelines and components.

The universality and usability of modern devices has resulted in greater demand for the design of localised user-interfaces. Upcoming or already available technologies and frameworks allow creation of flexible and responsive user-interfaces for the cultural-specific user of web-enabled mobile devices. For sustainable online cultural identity and literacy, it is important to have an efficient and practical development process and guidelines.

My research project intends to enhance the ability of Malay users to read and understand the Malay language and culture using the Jawi script. According to Ferdman (1990), "becoming literate means developing mastery not only over processes but also over

the symbolic media of the culture – the ways in which cultural values, beliefs and norms are presented" (p. 188).

Besides the visual language of Tirta Nirmaya, familiar interaction elements are assimilated in the design of the user-interface. Greenberg, Carpendale, Marquardt and Buxton (2012) recommend design sketching to express and highlight user-interface interactions and the process involved. Part of the design sketching methodology involves "visually illustrating an interaction sequence over time" (Greenberg et al., 2012, p. 147). Thus, in Chapter 4, I sketch a sequential storyboard for the design prototype to display and capture scenarios of the target user group interacting with the user-interface.

At present, no specific guidelines exist for the user-interface design process within the Malay culture. The Islamisation of the Malays and their aesthetically impressive culture may provide practical strategies for the production of specific design guidelines. The "elegance of calligraphy", the "characteristic arabesques, geometric motifs, and floral and foliate meander patterns common to other Malay decorative art" and the "naturalistic depiction of flowers and the vibrant use of colour" may provide the systematic iteration during the ideation of the overall aesthetics (Gallop, 1994). The combination of culture and process guidelines could be used as a framework for the development of a Malay user-interface.

A Malay user interface requires a specific and careful ideation and exploration process. Gould et al. (2000) and Nasrul, Masrom, Nor and Syarief (2012) present essential data about the perspective of users in Malaysia that clarify the process that relates to the Malay culture. These data facilitate the process of identifying user preferences as part of the

ideation of creating user-interface elements. Thus the ideation and exploration process may lead to an intended design process of localised user-interface design elements.

An understanding of the practical framework for responsive web design is also important. The flexibility inherent in the internet can be embraced without surrendering the control we require as designers, by embedding standards-based technologies in one work, and by making slight changes in our philosophies of online design (Marcotte, 2011). The application of these philosophies is further explored in Chapter 5. My review of the literature follows.

Human-Computer Interaction & Globalisation

This section examines the study of Computer-Human Interaction within the wider field of Human-Computer Interaction. I examine Grudin's theory of Computer-Human Interaction (Grudin, 2012), as well as the relationships between globalisation, culture, usability and user-interface design theorised by Akyin (2005), Barber and Badre (1998), Nielsen (1993) and Sneiderman (1998) in order to adapt and utilise the reviewed theories in my research project.

I also explore the practicality of a responsive design. I analyse the usefulness of responsive design elements including typography, images and layout. Marcotte's theory of responsive web design is reviewed, together with Wroblewki's mobile first design approach. I will examine a "mobile first" design approach mainly because, as explained above, the majority of the target Malay users already use mobile devices. Wroblewski indicates that the mobile first design enables designers to focus on the "constraints inherent in mobile design" and "deliver innovative experiences" (Wroblewski, 2012). The outcomes were applied to my project.

Malay Users

This research project involved the formulation of process guidelines for the development of a user-interface based on the typography of a specific culture. The user-interface design of the prototype is intended to assist more than 300 million Malay-speaking internet users to retain their cultural identity online. The theories, frameworks and approaches I examined and adapted constitute a methodological foundation to understand the specific target group, the Malays.

In this section, I seek to understand the target group for my research – the Malays. I analyse several theories that influence the origin and development of the Malay culture. Annabel Gallop's seminal book, *The Legacy of the Malay Letters*, is cross-referenced with the theories of John Milner, Syed Naguib Al Attas, Raja Fauziah Raja Tun Uda and A. R. Al-Ahmadi. My critical analysis of their theories underpins my exploration of the idea generation and techniques necessary for designing a user-interface that presents Malay cultural content.

2.1 Human-Computer Interaction & Globalisation

Newman's and Sproull's Principles of Interactive Computer Graphics (1979) describe a dynamic shift in personal communications, a shift also mentioned by Foley and Wallace (1974 cited in Grudin, 2012); they claim that there exists an "interactive graphics system whose aim is good symbiosis between man and machine" (p. xxxvi).

A decade later, Card, Moran and Newell (1983) described Human-Computer Interaction as the theory of a "communicative dialogue" between the user and computer. Grudin referred to Card and colleagues as the ones who introduced a "keystroke-level model for user performance time with interactive systems" (2012), based on communicative dialogue between the users and the interactive systems through the graphical interface (Card et al., 1983). This direct relationship between humans and the computer interface is in itself an emergent development of computers (Card et al., 1983; Grudin, 2012).

Card et al. introduced cognitive modelling as a research tool for human information processing and task analysis (1983). According to Human-Computer Interaction theorists, cognitive modelling consists of "GOMS (goals, operators, methods and selection rules) task analysis method and the keystroke-level model (KLM) for user performance time with interactive systems" (Cox & Peebles, 2008; Grudin, 2012; Norman, 2003; Shneiderman, 2004; Shneiderman & Plaisant, 2010). Norman (1998) suggests that the modelling includes some quantitative measurements as the scientific method is precise and repetitive. In the context of my research project, I intended to characterise what Grudin believes to be the still developing and sometimes confusing communicative relationship between human and computer interface (Grudin, 2012).

Grudin summarised the study of human-computer interaction into four fields: human factors and ergonomics, information systems, computer-human interaction and information fields (Grudin, 2012). My research project focused on computer-human interaction.

Shneiderman and Plaisant describe the Computer-Human Interaction field as follows:

> *Researchers created the interdisciplinary design science of human-computer interaction by applying the methods of experimental psychology to the power tools of computer science. Then they integrated lessons from education and industrial psychologist, instructional and graphics designers, technical writers, experts in human factors or ergonomics, information architects, and adventure-some anthropologists and sociologists. (Shneiderman & Plaisant, 2010)*

Jonathan Duckworth, an interaction designer, states that due to the multi-disciplinary nature of Human-Computer Interaction, "understanding how users interact with computers and new technology is representative of a larger research problem" (Duckworth, 2010, p. 14). Putting the problem in context, Bert Bongers and Gerrit van der Veer explain that "in order to develop better interfaces between people and technology, knowledge is required about all partners involved in the interaction: humans and technology, or in a broader sense, the natural and the artificial" (Bongers & van der Veer, 2007, p. 91). I sought to tackle the problem systematically by analysing idea generation and design techniques that apply to the target user needs and available technology.

Hands-on computer use and ease of use have always been synonymous with user needs. The purpose of a computer is to meet the needs of the user (Cox & Peebles, 2008; Grudin, 1992; Marcus, 2012; Nielsen, 1993; Norman, 2004; Shneiderman, 1998; Shneiderman & Plaisant, 2010). The usefulness of a particular system to achieve some desired goal can be broken down into the two categories of utility and usability (Grudin, 1992). Clearly, the graphical interface of the computer needs to be useful for the users.

Given that a useful system needs to achieve desired goals, the system functionality has to be what the user wants. According to Nielsen (1993), "utility is the question of whether the functionality of the system in principle can do what is needed" (p. 25). Shneiderman and Plaisant (2010) point out that diverse users have physical, intellectual and personality differences. Hence, understanding the users can assist the designers in developing a system's functionality.

Nielsen (1993) points out that "usability is the question of how well users can use that functionality" (p. 25). He explains that the concept of usability "applies to all aspects of a system with which a human might interact" (p. 25). Shneiderman and Plaisant (2010) further note that ordinary users can now access applications that previously served professionals. Thus, a usable and functional system for all provides an avenue for user-generated content.

User-generated content can now be easily shared with millions of users on the World Wide Web regardless of their geographical location (Shneiderman & Plaisant, 2010). Shneiderman (2003) claims that "an important step towards the new computing is to promote the compelling goal of universal access to information and communication services" (Definining Universal Usability, para. 1); this will enhance users' productivity and

enjoyment when engaging with product and services (Marcus & Gould, 2012). Thus, users and their cultures should also be considered when designing user-interface elements so that they can easily access the data and functions they require.

Nielsen (1993) defined usability as all humans being able to interact with all aspects of a system. Nielsen (1993) notes, “increasing technological sophistication in many countries of the world and the resulting larger world trade imply a greater need to pay attention to international aspects of user-interfaces” (p. 237). He also notes that “since users are known to be very different, it is probably better to consider the entire distribution of usability measures and not just the mean value” (Nielsen, 1993, p. 27). In my research project, I explored the usefulness of such aspects of the user-interface.

Usability consists of multiple components and is associated with five usability attributes. Nielsen (1993) argues that “usability is not a single, one-dimensional property of a user-interface” (p. 26). The five usability attributes are learnability, efficiency, memorability, errors and satisfaction (Nielsen, 1993; Nielsen & Loranger, 2006). The practicality of the attributes can be universally applied across different scenarios and user groups.

As previously mentioned, the Universal Declaration of Human Rights states that applications should be “accessible to all, affordable, adapted to local needs in languages and culture, and support sustainable development” (Shneiderman & Plaisant, 2010, p. 29). This declaration is further supported by the International Organisation for Standardisation (ISO), which holds that usable interfaces should be “effective, efficient and satisfying” (Marcus & Gould, 2012, p. 343). Shneiderman and Plaisant (2010), Marcus, Gould, Barber and Badre concur that a systematic process is required for the design of user-interfaces in a globalised

world. I observe that a process to accommodate global users is crucial to designers seeking to cater to a cultural-centric user target group.

2.1.1 The Globalisation Process

In the context of designing a user-interface for a cultural-centric user group, I considered Al-Rodhan and Stoudman's (2006) interpretation of globalisation as "not a single concept that can be defined and encompassed within a set time frame, nor … a process that can be defined clearly with a beginning and an end" (p. 3). They also state that one's "political ideology, geographic location, social status, cultural background, and ethnic and religious affiliation provide the background that determines how globalisation is interpreted" (p. 3). Al-Rodhan and Stoudmann (2006) conclude that "globalisation is a process that encompasses the causes, course, and consequences of transnational and transcultural integration of human and non-human activities" (p. 5).

Aykin, deriving the definition of globalisation from the Localisation Industry Standards Association (LISA) in *The Localisation Industry Primer* (LISA, 2001), agrees with Al-Rodhan and Stoudmann. Aykin (2005) defines globalisation as "the general process of worldwide economic, political, technological, and social integration" (p. 4). Aykin (2005) also explains that globalisation can be understood as the selling of a product to the global market (p. 4) Exposure to globalisation affects how different cultural elements can be infused into the design of a user-interface for the target user group.

Would it be chaotic and confusing if designers designed towards every need of users from every available culture on earth? Aykin (2005), an established user experience researcher, asserts "to go global, your company will need to define new roles and processes if it is to carry out the internationalisation process successfully" (p. 3). Marcus and Gould

(2012) echo this idea, arguing that "global product distribution requires a strategy and tactics for the design process that infuse international and cultural requirements into product development, marketing, distribution and maintenance" (p. 343). In order to prevent unnecessary design disorder, the focus should be based on business needs, user needs and technology considerations (Aykin, 2005).

Merging business or community needs with user satisfaction should be the goal of user-interface designers. Marcus and Gould insist that designing is about "satisfying user experience that extends across all appropriate products and services" (p. 343). They acknowledge that the goal of designing is to efficiently provide support systems for the localisation and translation of design products and services (Marcus, 2000, 2005; Marcus & Gould, 2012). However, before understanding the purpose of the support system, we need to understand the cultural model of the targeted user group.

2.1.2 Identifying the Cultural Model

To systematically understand culture, I refer to theorists such as Hall (1976), Hofstede (1991) and Trompenaars and Hampden-Turner (1998), who have created models that reveal the complex reality of culture. Rincon (2013), in his doctoral thesis, points out that Kroeber and Kluckhohn had reviewed more than 300 definitions of culture in 1954. Hall (1976), Hofstede (2010) and Trompenaars (2012) view culture as a group of people who come together to understand and systematically resolve complex issues. For my research, I needed to understand the cultural model or dimensions.

Culture can be defined and perceived differently in different contexts. Marcus and Gould (2012), in the context of global user-interface design and localisation opportunities, insist that "it is important to recognise that cultural differences are real" (p. 354).

Anthropologist Edward T. Hall (1976) explains that culture "designates what we pay attention to and what we ignore" (p. 85). Given the multiplicity of definitions and theories of culture, I will only summarise the cross-cultural communication frameworks theorised by Hofstede (1980), Trompenaars (1998) and Hall (1976).

Hall's theories on cross-cultural communication relate to practical fields that include design and business communications. Rincon (2013) summarises Hall's cultural variables as "contexting, speed of messages, space, time and information flow" (p. 34). Hall (1976) believes that the cultural variables he has identified are enablers for cultural literacy and that we "can all benefit from a deeper knowledge of what an incredible organism we really are" (p. 7). These leading social psychologists and anthropologists have created models and dimensions from data collected from surveying target groups within the field of human computer interaction.

Sustaining effective communication is difficult without an understanding of the cultures in which one lives. Trompenaars (1993), citing Schein (1985), explains that culture is "the way in which a group of people solves problems and reconciles dilemmas" (p. 6). Trompenaars and Hampden-Turner (2012) wrote:

> *A fish discovers its need for water only when it is no longer in it. Our own culture is like water to a fish. It sustains us. We live and breathe through it. What one culture may regards as essential – a certain level of material wealth, for example – may not be so vital to other cultures. (p. 27)*

Rincon (2013) and Gould et al. (2000), in the context of user-interface design, categorically summarise Trompenaars' basis of cultural differences into universalism and

particularism, individualism and communitarianism, specific versus diffuse relationships, neutral versus affective communication styles, achievement and ascription, time orientation and nature orientation.

As my research was about exploring the ideation and techniques in the development of user-interfaces based on the Malay culture, and not the development of a full application with user testing, I needed to understand cultural dimensions within the field of human computer interaction. Marcus and Gould (2012) wrote that "the Dutch cultural anthropologist Geert Hofstede conducted detailed interviews and surveys with thousands of IBM employees in 53 countries. Through standard statistical analysis of large data sets, he was able to determine patterns of similarities and differences among their replies" (p. 355). Marcus and Gould summarised Hofstede's dimension of culture in terms of power distance (PDI), collectivism/individualism (IDV), femininity/masculinity (MAS), uncertainty avoidance (UAI) and long term/short-term time orientation (LTO) (Marcus, 1995, 1998, 2000, 2005; Marcus & Gould, 2012). Most importantly for my research, Marcus' explanation (which I will summarise in Chapter 3) of the dimension of culture in designing user-interfaces has enabled him to contribute a theory in the field of Human Computer Interaction.

The data collected from the cultural model and dimension can be used repeatedly according to different project requirements. According to Nancy Hoft (1996), the President of International Technical Communication Services in the United States of America, "with a cultural model you are able to gather cultural data again and again for the purposes of comparing and contrasting how groups of people think, feel, and act in different situations as defined by your statement of purpose" ("Applying Cultural Data", para. 1). Marcus and Gould agree with Hoft when they mention that analysis of the cultural model, in particular

Hofstede's, "has tremendous face validity and is widely used in the fields of management and intercultural and organisational communication" (2012, p. 355). Thus, data collected from previous studies may provide a useful cultural perspective on my own target user group, the Malays.

I observe that selecting an appropriate cultural model can lead to a better understanding of the culture of the target user group and streamline the design process. Hoft (1996) asserts that "to be able to select meaningful international variables you must first understand how and where culture comes to influence our lives in such a profound way" ("Selecting Meaningful International Variables", para. 1). In this research, I consider the variables Hoft derived from Hofstede's Pyramid Model and Trompenaars' Onion Model. Hoft (1996) summarises the models as follows:

1. ***Hofstede's Pyramid Model*** attempts to show the origin of culture and why it is unique in human mental programming:
    i. **Personality** - specific to an individual where it is learned and inherited
    ii. **Culture** - specific to a group of people which is learned but not inherited
    iii. **Human Nature** - universal to all human beings where it is inherited and not learned.
2. ***Trompenaar's Onion Model*** indicates a three-layer metamodel of culture variables:
    i. **Outer Layer** - "the observable reality of the language, food, building, houses, monuments, agriculture, shines, markets, fashions and art. They are the symbols of a deeper level of culture" (Cited in Hoft, 1996, p. 50)

ii. **Middle Layer** - the norms and values that indicate right or wrong, desirable or undesirable and good or bad

iii. **Core** - the basic assumptions of human existence in ways whereby they implicitly identify how they adapt to a particular environment.

In the process of understanding the variables from the cultural model, I sought to construct what Marcus referred to as "patterns of thinking, feeling and acting" that could be applied to the user-interface design framework or guidelines recommended by Marcus, Grudin and many other experts.

In the context of my target user group, important results can be retrieved from several research papers based on Hofstede's or Trompenaars' models and dimensions. Gould et al. (2000), in their research paper "Applying culture to website design: A comparison of Malaysian and US websites", provide guidelines based on their review of "the cross-cultural theories of Geert Hofstede and Fons Trompenaars" (p. 161). Nasrul et al. (2012), in, "Website user-interface characteristics for multi-racial settings in Malaysia", investigate differences in preferences according to the cultural backgrounds of the user target group. The data and findings from the papers are explored further in coming chapters.

2.1.3 Culture-Centred Design

Grudin (2012) states that the graphical user-interface (GUI) is especially attractive to consumers, whether they are new or casual users. In praise of user-interface designers, Shneiderman (1998) writes that "the work of designers has turned the personal computer into the social computer, enabling users to communicate and collaborate in remarkable

ways" (Shneiderman, 1998). Grudin and Shneiderman's observations provide a relevant design strategy for a specific cultural group such as the Malays. Their understanding of the cultural model and its application to graphical user-interface (GUI) design assisted the idea generation and design process of my research project.

According to theorists in the field of Computer-Human Interaction, since the early 1980s researchers have striven for a comprehensive, theoretical and psychological framework for HCI based on formal experiments (Barnard, 1991; Carroll & Campbell, 1986; Grudin, 2012; Long, 1989; Newell & Card, 1985). For Grudin (2012), such a framework was conceivable for constrained command- and form-based interaction, but could not be scaled to design spaces that included colour, sound, animation, and an endless variety of icons, menu designs, and window arrangements. Many years later, computer-human interaction theorists such as Shneiderman and Marcus prepared process guidelines for designers. These guidelines may have been systematically streamlined for a cultural-centric user-interface design and cultural usability.

In this section, I explore Barber and Badre's notion of culturability and review Shneiderman's Guideline Document and Process when designing a successful user-interface. To understand the user-interface design approach, I refer to Shneiderman's Golden Rule of Interface Design (Shneiderman, 1998; Shneiderman & Plaisant, 2010).

2.1.3.1 Culturability - The Relationship between Culture and Usability

Culturability is a term coined by Barber and Badre (1998) at the Microsoft Research Lab. They argue that there is a need to "emphasize the importance of the relationship between culture and usability" in user-interface design (Barber & Badre, 1998, p. 1). They further explain that in the context of interface design, interactivity and content requires the

understanding of (1) Genre/Knowledge Domain, (2) Cultural Marker and (3) Culturally Deep versus Shallow site (Barber & Badre, 1998). I summarise their findings below.

1. **Genre/Knowledge Domain** – the type of information that will be presented (how news and information are "stylistically displayed")
2. **Cultural Marker** – the design elements that are preferred by the target user group and how significant they are to the culture (common seals or insignia used conventionally throughout the interface design)
3. **Culturally Deep versus Shallow site** – a site which utilises and links to the native language of the target users versus utilising and linking to the secondary language of the target users.

Barber and Badre (1998) systematically methodised the useability of interface designs for cultural-specific user groups in their Culturability Inspection Method. They observe that culturability "is capable of capturing the cultural nuances of a targeted audience to enhance usability" (p. 4). They further explain that their research methods include "systematic usability, inspection of several hundred websites to identify culture and genre design elements" (Barber & Badre, 1998, p. 4). Therefore, the data variables gathered can be categorically applied when usability of the interface design is required.

Barber and Badre categorise the Culturability Inspection Method into three data acquisition stages: Foraging, Cultural Marker Identification and Pattern Identification (Barber & Badre, 1998). These stages are summarised below.

1. **Stage 1: Foraging**
    - This involves categorising hundreds of websites by country, genre and language so that the data can be examined based on their native language.

- Barber and Badre "hypothesize that sites in the country of origin's native language will depict cultural markers specific to that particular culture, whereas a site in a non-native language will be more influenced by outside cultural markers" (p. 6)

2. **Stage 2: Cultural Marker Identification**
    - These are design elements that are cultural markers when prevalently used in the design in a particular user group.
3. **Stage 3: Pattern Identification**
    - These are "emergent patterns within countries and genres and across regions, which can then be analysed for depth and World Wide Web design implications" (p. 9).

Culturability provides a more defined set of variables for my project with some usable design elements. Barber and Badre (1998) suggest that "usability must be re-defined in terms of cultural context, as what is 'user-friendly' for one culture can be vastly different for another culture" (p. 10). Although specific data for Malaysia's cultural groups are unavailable, the framework set by Barber and Badre was a very tempting potential direction for my research. Hopefully, Marcus' calls to design for the intended users can be effectively streamlined and systematically approached by the Culturability Inspection Method.

2.1.3.2 Guideline Documents & Process

In my personal design projects, I follow a set of processes that I have developed over years of experience. Shneiderman and Plaisant (2010) note that "in the first decades of computer-software development, technically oriented programmers designed text editors, programming languages, and applications for themselves and their peers" (p. 98). Later, I

realised that in the age of globalisation and rapid Internet usage, “the user population for mobile devices, instant messaging, e-business, and digital libraries is so vastly different” from what it had been on earlier decades (Shneiderman & Plaisant, 2010, p. 98). Therefore, the United Nations’ recommendation that user-interfaces should be “accessible to all, affordable, adapted to local needs in languages and culture, and support sustainable development” may need our attention through a well-documented guideline of processes.

In my professional endeavours as a researcher, teacher and designer, I have always depended on a set of process or guideline documents to execute the tasks at hand. Marcus and Gould (2012) insist that an accessible process and guideline in “the user-interface development process must also pay special attention to the user group and its culture” (p. 343). This process may encourage designers for users from different cultures to create usable and useful interface designs (Marcus & Gould, 2012; Shneiderman & Plaisant, 2010). Marcus echoes Shneiderman in stating that “with the rise of the Internet and application-oriented websites and mobile devices, the challenge of designing good user-interfaces has become an immediate, practical matter, rather than a theoretical issue” (Marcus & Gould, 2012, p. 343).

As noted in the definitions of cultural model by Hall, Hofstede, Trompenaars and Holt, understanding what is preferred in a certain culture can be complicated. Marcus and Gould (2012) agree that “productivity and enjoyment should be the primary design objective” (p. 343). With a vast group of users, Shneiderman and Plaisant (2010) recommend a “variety of design situations (that) preludes a comprehensive strategy” as well as “willingness to be flexible and open in the development process” (p. 99). In formulating my user-interface design for my project, this process may increase “the chances for successful user-interface development” (Shneiderman & Plaisant, 2010, p. 99).

In my research, I focused on words, icons and graphics and screen-layout issues. Words, icons and graphics consist of terminology, character set, fonts, icons, buttons, graphics and use of colours. Screen-layout issues involve menu selections, wording of feedback, justification, display formats for items, use/contents of headers and footers and strategies for adapting multiple displays (Shneiderman & Plaisant, 2010).

2.1.3.3 The Golden Rule

Shneiderman has compiled some useful guidelines that can be applied, together with Marcus' theory, to the design of user-interfaces specific to the Malay Muslim culture. Shneiderman's Eight Golden Rules of interface design are that designers:

> *(1) strive for consistency, (2) cater to universal usability, (3) offer informative feedback, (4) design dialogs to yield closure, (5) prevent errors, (6) permit easy reversal of actions, (7) support internal locus of control and (8) reduce short-term memory load.*

Shneiderman's Golden Rules and Marcus's guidelines for user-interface design complement each other by documenting and standardising the design process. Furthermore, Nasrul et al. (2012) observe that "while studies on website design and culture have been conducted in developed countries, it is still limited in developing countries such as Malaysia" (p. 252). Nevertheless, based on Nasrul et al.'s (2012) laboratory findings about a Malay website's interface and the research-based recommendations of Gould et al. (), a guideline for designing a user-interface for Malay Muslim culture can be formulated.

There is limited availability of literature regarding Malay user interfacedesign based on Jawi script. In view of the lack of literary examples for guidelines specific to a Malay user

interfacedesign, I scrutinised Marcus' guidelines on the critical aspects of globalisation in the user-interface design process based on the Malay target user group. Marcus' guidelines are examined and applied in later chapters; they are:

> ***User Demographics:*** *Identify target user population in terms of national or cultural specific user-interface components.*
>
> ***Technology:*** *Determine the appropriate media with emphasis on sound, visual and 3D tactile media.*
>
> ***Metaphors****: Essential concepts conveyed through words and images, or through acoustic or tactile (haptic) means.*
>
> ***Mental Models****: Organisation of data, functions, task, roles and people in groups at work or play.*
>
> ***Navigation:*** *Movement through mental models, afforded by windows, menus, dialogues areas, control panels, touch screens and so on.*
>
> *I**nteraction:*** *The means by which users communicate input to the system and the feedback supplied by the system.*
>
> ***Appearance****: Verbal, visual, acoustic, and tactile perceptual characteristics of displays.* (Marcus, 1995, 1998, 2006; Marcus & Gould, 2012)

2.1.4 Responsive Design

In this age of interactive online content, users expect software to be responsive and usable on any available media platform – laptops, smart mobile devices, tablets and personal computers. Aaron Gustafson (2011), in his book *Adaptive Web Design: Crafting Rich Experiences with Progressive Enhancement*, asserts that "progressive enhancement is a philosophy aimed at crafting experiences that serve your users by giving them access to

content without technological restrictions" ("Think of the User…", para. 2). Grudin (2012) describes "the history of interaction as the story of the computer "reaching out", in which interaction moves from being directly focused on the physical machine to incorporating more and more of the user's world and the social setting in which the user is embedded. For the user to have a useful experience, user-interface design has to operate with any web-enabled devices and screens.

Almost all modern digital devices are web-enabled. To be able to reach out, as highlighted by Grudin, Marcotte has stated that:

> *Rather than tailoring disconnected designs to each of an ever-increasing number of web devices, we can treat them as facets of the same experience. We can design for an optimal viewing experience, but embed standards-based technologies into our designs to make them not only more flexible, but more adaptive to the media that renders them.* (Marcotte, 2010, 2011, 2014, p.8)

As mobile devices receive more user attention, user-interface designers need to recalibrate their designs to incorporate a flexible grid-based layout, fluid images, fluid media and media queries (Marcotte, 2010, 2011, 2014; Wroblewski, 2011). The Responsive Web Design philosophy that Marcotte highlighted above is not part of new web design knowledge but is, in fact, an achievable practical solution. He maintains that "responsive thinking increases your vocabulary for addressing user-interface challenges on a variety of devices and viewing context" (Marcotte, 2010, para. 1). In the context of my research project, I realised that the evolving philosophy together with advancement in technology required me to recalibrate my user-interface design process.

To recalibrate how we approach designing user-interfaces for the web, we need to understand the mobile first design approach. Wroblewski (2011), an internationally recognised digital product leader, explains that "designing for mobile first now can not only open up new opportunities for growth, it can lead to a better overall user experience for a website or application" (p. 1). He further asserts that mobile first design enables designers to focus on the constraints and capabilities that are present in mobile devices. I observe that usable responsive design elements can be achieved by assimilating Wroblewski's mobile first philosophy with Marcotte's description of responsive web design.

Understanding the inter-relationship of interactive website, design and development methodology is important in the design of an application that is adaptive and responsive to any screen size. Luzuriaga (2011) explains that "it's important to understand that a website is not one or the other; it's a marriage of both design and code, each depending on the other to create a seamless experience" ("The Designer's Role", para. 3). Sharkie and Fisher (2013) point out that "the aim of these pillars [design and code] was to achieve the elusive 'write once, run anywhere' goal" (p. 3). Therefore, responsive design requires designers to understand the functionality of web browsers on multiple devices. Because of this, I can already foresee design headaches because of the availability of different browsers, even on a single mobile device. Marcotte (2011) reminds designers that they need to create a design that "can adapt to the constraints of the browser window or device that renders it, creating a design that almost responds to the users' needs" (p. 9). Craig Buckler (2012) concurs that "when used well, your site can be viewed on any device no matter what the screen resolution or orientation" ("The Responsive Web Design Bookmarklet", para. 1). However, Nielsen (2012) disagrees when he states, "good mobile user experience requires a different

design than what's needed to satisfy desktop users; two designs, two sites and cross-linking to make it all work" ("Mobile Site…", para. 1). Although it has been argued that Nielsen's approach will cost more to develop (Combrinck, 2012; Lawson, 2012; Spool, 2012), it is more important to understand users' browsing preferences than to consider only the browsers' functionalities on different devices.

Designers need to understand the technical specifications presented to them. Marcotte and other developers have helped designers through their explorations of current web coding technology, flexible grid-based layout and responsive media elements. Similarly, Wroblewski (2011) has provided designers with statistical evidence of mobile functionality such as the availability of mobile devices on the current global market, traffic to mobile browsers and the applications that users frequently use. In my research, responsive design approaches, together with the cultural models described earlier, assisted in the ideation and exploration of my user-interface design.

I realise that there may be a need to investigate the user-interface design for responsive web design. Marcotte (2011) points out that users and designers alike are "faced with a browser landscape that's become increasingly untethered from the desktop" (p. 6). Rather than creating disconnected designs, each tailored to a particular device or browser, we should instead treat them as facets of the same experience (Marcotte, 2011). Acquiring knowledge of the target user group can eliminate unnecessary repetition of design and development of the user-interface. However, it has been claimed that responsive web design has technical problems, including a "lack of static design phase, navigation and images" (Young, 2012). The long and short of it is that we are designing for more devices, more input types, and more resolutions than ever before (Marcotte, 2011).

Young (2012) recommends creating more elements than just layout. He also suggests using a good and consistent design for navigation and using scalable vector graphics (SVG), scripting and iconic fonts for fluid images (Young, 2012). Wroblewski (2011), Wilcox (2012) and Emerson (2012) have discussed similar practical approaches to fluid or adaptive images. Marcotte (2011) simply refers to the designing of fluid images as "creating a design that's founded on a system of proportions and percentages, with nary a pixel in sight" (p. 63).

2.2 Malay Users

I sought to understand what Nagata (1974), Al Attas (1976), Hooker-Matheson (2003), Milner (2008) and many other theorists mean when they claim that the Malay culture is complex. For example, Milner (2008), in his book *The Malays (The People of South-east Asia and the Pacific)*, quoting from the constitution of Malaysia, defines the Malay as "someone who (in addition to fulfilling certain residential requirements) professes the Muslim religion, habitually speaks the Malay language, and conforms to Malay custom" ("Who are 'the Malays'", para. 4). Nagata (1974), in relation to the definition of the Malays, states that custom (*adat*) has "a variable domain of meaning" (p. 335). These definitions suggest that the complexity of the Malay culture revolves around custom (*adat*).

In my effort to understand the complexity of the Malay culture, I searched widely for written evidence. I was curious about Milner's (2008) claim that "gaining access to the thought world of the people (Malays) of such poorly documented societies is not easy" ("Civilizational Perspectives", para. 1). Of relevance here is Nagata's study on the common factor of the Malay culture, namely, the Islamic belief, rather than ethnicity (Nagata, 1974).

The commonality within the Islamic belief has narrowed down my inquiry into the Malay culture.

A nineteenth-century Malay Muslim scholar, Al 'Alim Al 'Allamah Az Zaki Asy Syeikh Wan Ahmad Bin Muhammad Zain Al Fathani, sums up the Malays as follows:

> *Bangsa Melayu itu adalah bersifat ikhlas, lemah lembut, lunak, berperibadi sopan. Mereka memiliki kehormatan yang sopan, menguasai pembaikan pertukangan, menerima pemodenan teknologi, mereka memperoleh pendidikan dan ilmu pengetahuan serta kecemerlangan kefahaman padanya.* (Al Fathani, 1882)

> *The Malays are sincere, gentle, soft-spoken, courteous. They possess a noble respectability, master developments in craftsmanship, accept technological modernisation, and they acquire education and knowledge and excellence in understanding.*

For another definition of the Malays, I refer to the perspective of the nineteenth-century Christian evangelist, Sir Frank Athelstane Swettenham. In *Malay Sketches* (1895), Swettenham portrays the Malays as colonial outsiders who "are polite and easy" with "courageous and trustworthy" traits. Swettenham elaborates, stating that the Malay is "conservative to a degree, is proud and fond of his country and his people, venerates his ancient customs and traditions, fears his Rajas, and has a proper respect for constituted authority." Here, Swettenham has the same perspective as his contemporary Malay scholar.

In contrast, in other writings Swettenham gives a very different description of the Malays. Swettenham states that the Malay is "lazy to a degree, is without method or order of any kind, knows no regularity even in the hours of his meals and considers time as of no

importance" (p. 2). He brands the Malays as "untidy, even dirty, but he bathes twice a day" (Swettenham, 1895, p. 2). Of course, it is inevitable that Swettenham, coming from a very different culture and geographical location, should perceive some aspects of people and culture very differently to a local scholar.

In other accounts of the Malays, they are categorised as an Austronesian people (Milner 2008). The Proto-Malays are of Austronesian origin, migrating to the Malay Archipelago between 2500 and 1500 BC, mainly from Southern China (Ryan, 1976). Deutero-Malays came from mainland Southeast Asia, and there is also evidence of Indian as well as Perso-Arabic influences (Ahmad, 1978; Devan, 2010; Gallop, 2008).

Sulalatus Salatin (The Malay Annals) is a meticulous literary commentary on the Malays from a sixteenth-century Malay Scholar, Tun Seri Lanang. In the original manuscript, written in Jawi script, he explicitly documents the history of the Malays and their kings. Over the years, there have been numerous versions of the document. The document was transliterated, translated and interpreted by Leyden (1821), Shellabear (1896), Windstedt (1938) and Ahmad (1979). All state that the coming of Islam had a powerful influence on the people of the Malay Archipelago (Leyden, 1821; Samad, 1979; Shellabear, 1896; Windstedt, 1938).

Nevertheless, there is evidence of distinctively Malay arts and culture prior to the coming of Islam (Ali, 1994; Raja Tun Uda & Al-Ahmadi, 1997). In *Islamic Civilization in the Malay World*, Raja Tun Uda and Al-Ahmadi (1997) state that "archaeological findings have provided evidence of the practices and rituals performed by these early communities" (p. 282). These early communities were from the Palaeolithic and Dongson Ages. Islamisation of the Malays in the early twelfth century resulted in changes to the traditional cultural and artistic practices of the Malays.

Raja Tun Uda and Al-Ahmadi (1997) explain that with the coming of Islam, the arts and culture of the Malays "shift[ed] from being primarily mythological-animistic to being more rational and philosophical in nature" (p. 285). Clearly, the continuing influence of Islam on the arts and culture of the Malays requires close examination.

2.2.1 The influence of religion among the Malays

Islam is a monotheistic religion. It is articulated in the Qur'an in chapter 112 verse 1, "He is Allah (God), the One!" and also in chapter 51 verse 56, "I (God) created the jinn and mankind only that they might worship Me" (Qur'an). Islam is also an Abrahamic religion: as the Qur'an states in chapter 2 verse 135, "And they say: Be Jews or Christians, then ye will be rightly guided. Say (unto them, O Muhammad): Nay, but (we follow) the religion of Abraham, the upright, and he was not of the idolaters" (Qur'an). (Of course, despite this shared Abrahamic origin, many of Islam's theological beliefs and religious practices differ substantially from those of Jews and Christians.)

Muslims, the practitioners of the Islamic religion, adhere to the Qur'an, which is the verbatim word of God as revealed to the Prophet Muhammad Ibn Abdullah (peace and blessings be upon him), whom they regards as the last prophet of God. They also follow Prophet Muhammad's teachings and examples (Sunnah or Hadith). In addition to the Qur'an and Sunnah or Hadith, Muslims follow the analogical reasoning and consensus of the first three generations of Muslims, as well as the jurists and scholars of the Muslim world. These adherents form the basic principles of traditional Islam practised by all Muslims.

Prophet Muhammad, born on 20 April 571 CE (An Nadwy, 1930; Lings, 1983), received his first revelation as a prophet of God on 6 August 610 CE at the age of 40 (An Nadwy 1930; Lings 1983). Muhammad preached the revelations from God until his death on

8 June 634 CE, when he was 63 years old (An Nadwy, 1930); by this time, Islam had spread to most parts of the Arabian Peninsula. Prophet Muhammad's teaching and examples were continued by the Rightly Guided Caliphs, Abu Bakar, Umar, Uthman and Ali. Islam now reaches across the world; its hundreds of millions of adherents can be found worldwide.

Before Islam came to the Malay Archipelago in the early twelfth century, some Malays practised a monotheistic religion (Samad, 1979; Shellabear, 1896; Windstedt, 1938). Tun Sri Lanang (1615) states that the Malays are the descendants of Raja Iskandar Zulkarnain, who adhered to a monotheistic religion during the time of Prophet Abraham. Ali Ibn Al Athir's important historical work, *Al-Kamil fi'l Tarikh* (The Complete History) written in 1231, states that the Malays are descendants of Prophet Abraham (trans. Richards, 2008). Therefore, when monotheistic Islam came to the Malay Archipelago in the twelfth century, the people accepted it easily (Johns, 1961; Milner, 2008).

Trading also facilitated the spread of Islam in the Malay Archipelago (Johns 1961, 1975; Milner 2008). As Laffan (2011) notes, "Southeast Asia lies at the intersection of two trading zones of significant antiquity" (p. 4). Some historians and academics argue that Islam came to the Malay Archipelago directly from the Middle East rather than via India (Al Attas, 1969, 1972; Azra, 2004; Fatimi, 1963). Fatimi (1963) and Azra (2004) cite evidence that Islam came from India, specifically Gujarat and Malabar, in literature by orientalists such as Christiaan Snouck Hurgronje.

In *Sulalatus Salatin*, Tun Sri Lanang describes Islam's introduction to the Malay Archipelago following the arrival of Captain Syeikh Ismail in 1536. His ship sailed to the Malay Archipelago from Makkah (aka Mecca, in the Arabian Peninsula) via India. The journey was undertaken at the command of the *syarif* (ruler) of Makkah in accordance with a hadith (saying) of the Prophet Muhammad:

It is related in the hadith of the prophet Muhammed, that he said to his companions, 'In the latter times men shall hear of an island under the wind, named Samadra (Semundra); as soon as this shall happen, go and convert it to Islamism, for the island shall produce many Wali-Allah (saints), or persons of gifted piety; but there is a gnostic of the land of Matabar (Mutabari), whom you must carry along with you.' (Leyden, 1821; Samad, 1979; Shellabear, 1896; Windstedt, 1938)

Most translators of and commentators on *Sulalatus Salatin* agree that the "island under the wind" is the Malay Archipelago (Leyden, 1821; Samad, 1979; Shellabear, 1896; Windstedt, 1938).

The Malay Archipelago is a group of islands located between mainland Southeast Asia and Australia. It includes countries such as Singapore, Malaysia, The Philippines, Indonesia, Brunei and Papua New Guinea (Encyclopaedia Britannica, 2006), although the nineteenth-century naturalist Alfred Russell Wallace believed the region extended as far south and east as the Solomon Islands (Wallace, 1863; 1869).

2.2.2 Malay Culture and Art

The assimilation of Islam into the local culture and arts of the Malays between the twelfth and fifteenth centuries can be "attributed to the tireless efforts of Sufi *ulama* (scholars)" (Johns 1961, 1975; Raja Tun Uda & Al-Ahmadi, 1997). Uda and Al-Ahmadi (1997) cited Sulaiman Esa's *The Reflowering of the Islamic Spirit in Contemporary Malaysian Art* in stating that the Sufi *ulama* "shaped the philosophy, form and content of traditional Malay arts" (p. 286). According to Uda and Al-Ahmadi (1997), the manifestation of the Islamic spirit in Malay art can be seen in calligraphy, woodcarving, textiles, weaponry, Meuseukut dance and Ratib Saman.

According to Uda and Al-Ahmadi (1997), “prior to the coming of Islam, the people of the Malay Archipelago had already developed a distinct culture of their own” (p. 281). However, as previously mentioned, they observed that the Malay world-view changed from primarily mythological-animistic to more rational and philosophical with the coming of Islam. The influence of Islam on the material as well as the expressive art of the Malays is very apparent. Gallop (1994), in her book, *The Legacy of Malay Letters*, states that:

> *The finest Malay letters embody all that is most beautiful in Malay culture, civilisation and aesthetics, through the splendour of their illumination, the elegance of the calligraphy, the theological sophistication of the headings, the intricacy of the seals, and the courtly and refined language of the compliments. (p. 8)*

Uda and Al-Ahmadi explain that “creative expression, artists and craftsmen were being guided by specific principles in their activities” (p. 285). The Malays do everything with a core consciousness that is *tauhid* – the unity of Allah, god and creator of the universe. The consciousness in the unity of God and its relation to beauty is related to the saying of Prophet Muhammad:

إِنَّ اللَّهَ جَمِيلٌ يُحِبُّ الْجَمَالَ

Indeed, Allah is beautiful and He Loves beauty (Sahih Muslim, Book 1, Number 0164)

The appreciation of beauty in Islam was a catalyst for the Malays to produce excellent craftsmanship. The German-Jewish ethnographer and Arabist, Shelomo Dov Goitein (1966), claims that “art is perhaps the most original and most impressive contribution of Islamic civilisation to world culture” (p. 49). Furthermore, Uda and Al-Ahmadi point out that the Malay craftsman’s energy, after the coming of Islam, is expressed

in creating as “an act of devotion” (p. 286). Hence, the culture and arts of the Malays strongly portray adherence and acts of devotion to Islam.

The notion of an act of devotion is best reflected in Titus Burkhardt’s seminal book *Art of Islam, Language & Meaning*. Burkhardt notes that “the art of Islam … is abstract, and its forms are not derived from the Qur’an or from the sayings of the Prophet; they are seemingly without scriptural foundation, while undeniably possessing a profoundly Islamic character” (Burkhardt 2009, loc 284). Sutton (2007), in *Islamic Design: A Genius for Geometry,* explains that sacred art has an active role in the spirituality of Muslims.

It is generally accepted that the manifestation of Islamic character from the different art form is too simplistic. Nevertheless, Sutton (2007) insists that sacred art is designed “to instil a way of perceiving the world and the subtle realities behind it” (p. 1). Uda and Al-Ahmadi go further and affirm that “under the impact of Islam which emphasises man’s vertical relationship with God as well as his link with society, traditional Malay arts became not only spiritually enriching and socially integrative but also psychologically ennobling” (p. 286). Uda, Al Ahmadi and Sutton’s explanations of Burkhardt’s notion of Islamic character provide the foundation for some of my own design approaches.

Arabic calligraphy is an important aspect of Islam. Burkhardt (2009) recognises that “the entire life of a Muslim is filled with Qur’anic formulae, prayers, litanies, and invocations in Arabic, the elements of which are drawn from the Sacred Book” (p. 151). Similarly, Gallop (1994) greatly admires the illumination and calligraphy of Islam-influenced Malay letters. The Arabic-based Jawi calligraphy present in the Malay culture are elements of what Uda and Al-Ahmadi termed “acts of devotion”.

2.2.2.1 Calligraphy in the Malay Culture

My calligraphy teacher advises that a true calligrapher writes with his heart and not the pen. Ibn Khaldun, the fourteenth-century historian and sociologist, explains that "writing is the outlining and shaping of letters to indicate the audible words which, in turn, indicate what is in the soul" (trans. Rosenthal, 1958, p. 377). Ibn Khaldun further says that calligraphy is a craft which differentiates man from animals. Words and phrases are shaped from the mind and heart to enable learning.

The Malay Archipelago was already rich with calligraphic script, such as the Hindu-Buddhist influenced Pallava script used in the Malay language, before the introduction of Islam. Uda and Al-Ahmadi (1997) note that "(t)he advent of Islam introduced the Malay world to Arabic writing and Arabic alphabets" (p. 295). The adoption of Arabic script in the Malay language produced the Jawi script (Tun Raja Uda et al., 1997; McCabe, 2011; Musa 2006). Jawi script soon became the dominant script in the Malay world.

The qualities of the Jawi calligraphic script contributed to the spread of the Malay language throughout the region. Gallop (1998) affirms that the letters of the Jawi script "embody all that is most beautiful in Malay culture, civilisation and aesthetics" (p. 60). Uda and Al-Ahmadi (1997) note that the combination of Jawi script and the Malay language "sowed the seed for nurturing the growth of Islamic calligraphic tradition (*khat*) in the Malay world" (p. 295).

As Arabic is used in the teaching and learning of the Qur'an, Malays have adopted the Arabic script in their language (Tun Raja Uda et al., 1997; Musa, 2006). One of the earliest examples of Jawi script (dated 1303) was found on the Terengganu carved tablet; it urged Malays to adhere to Islam through the calligraphic script (Al-Attas, 1970; McCabe,

2011; Uda et al., 1997). According to McCabe (2011), Jawi script is “a system for disseminating information and innovation” (p. 23) in the Malay world.

The Malay language, written and read in the Jawi script, has contributed not only to the culture but the definition of Islam in the Malay world. Milner (2008) writes that between the fifteenth and nineteenth centuries, the Malay language was the language of the learned in South East Asia, comparable to Latin and French in Europe. When the Malay language adopted Arabic script, not only was it a dominant international language of commerce, but “it attained a cultural dimension” (Tun Raja Uda et al., 1997).

Because the Malay language was the lingua franca of the Malay world, the Jawi script was learned and understood not only by the Malays but every trader and traveller to the Malay world. The Arabic alphabet has 29 letters, and the Jawi alphabet an additional 6 (Musa, 1999). The additional letters accommodate sounds from the Malay language that are not represented in Arabic. Thus, communications and periodicals in Malay were written in the Jawi script rather than in Arabic.

The aesthetic qualities of the Malay letters, known as “The Golden Letters”, facilitated the common use of the Jawi script. Gallop (1994) describes the letters as “golden letters” because of their “striking visual beauty” as well as their “aesthetically impressive epistles” (p. 8-9). In addition, she explains that “(t)he art of Malay letter illumination is inextricably linked to the influences from the ‘lands above the winds’ in the west, whether from India, Turkey, Persia or Europe” (p. 41). The different cultural influences present in the Golden Letters are replicated in my research project.

The design elements of my project exhibit the globalised characteristic of the internet while maintaining a distinctively Malay aesthetic and motifs. Gallop (1994) observes that “the motifs generally found on illuminated letters from Malay rulers and

nobles are the characteristic arabesques, geometric motifs, and floral and foliate meander patterns common to other Malay decorative art" (p. 41). Gallop also notes the presence of European influences in Malay letters, such as the naturalistic depiction of flowers and the vibrant use of colour. Generally speaking, the symbiosis of the Malay and globalised characters in my design replicate the literary aesthetic present throughout the history of the Malay world.

One of the earliest historical examples of literary aesthetic was a letter from Sultan Iskandar Muda of Acheh to King James I of England (James XI of Scotland) written in 1615 (Gallop, 1994; Uda, 1997). The naturalistic depiction of nature and Islamic calligraphy are also evident in Malay woodcarvings, textiles and metal-smithing (Tun Raja Uda, 1997). Naturalistic depiction is consistent with "the ubiquitous presence of calligraphy in palace architecture, royal regalia, mausoleums, Malay houses, textiles, metalworks and letter writing" (Tun Raja Uda et al., 1997, p. 297). These letters functioned as an effective communication medium between the Malays and the rest of the world.

Gallop (1994) underlies the importance of the letters when she states "the whole history of the Malay lands and their intercourse with the rest of the world can be traced through the contents of the letters themselves" (p. 8). Uda and Al-Ahmadi (1997) support Gallop's statement when they state that "another dimension in which Arabic calligraphy has shown its mastery was in its inspiration to the development of the art of Malay letter writing" (p. 297). In *The Legacy of the Malay Letter*, Gallop (1994) made the most important statement in the field of research into Malay culture:

> *… until recently, little attention was paid to Malay letters as indigenous sources for a study of the history of the Malay world prior to the twentieth century, nor were they*

regarded as an important field for inclusion in studies of Malay artistic creations inspired and shaped by Islamic thinking. (p. 8)

Together with Gallop's findings, I envision that my research will provide the catalyst to enable a greater understanding of the Malay artistic character.

2.2.2.2 The Application of Calligraphy in Malay Culture

The Malay Letters were written in Jawi script and incorporated Qur'anic quotations or religious phrases. On the envelope, after the name and address of the intended recipient, would follow a prayer that Allah would cause the letter to arrive safely (Newbold, 1839 cited in Gallop, 1994). Uda (1997) states that there is evidence that Sultan Alauddin Riaya Shah of Acheh wrote to Queen Elizabeth I of England in 1601 using Arabic script. The quotation and phrases typically formed the heading of the letters.

With the Malay language becoming commonly written in Jawi script, the Islamisation of the Malay Archipelago proceeded rapidly (McCabe, 2011; Uda, 1997). The rewriting of the Qur'an or passages of it is an act of devotion, as proficiency in calligraphic writing is believed to produce good character in the person who writes it (Tun Raja Uda et al., 1997). This is in line with the person achieving core consciousness in *tauhid*. Therefore, proficient calligraphy enables the propagation of knowledge and understanding.

The discipline required to achieve proficiency is "the driving force behind the rapid and dynamic growth of Islamic calligraphy in Malay traditional arts" (Tun Raja Uda et al., 1997, p. 296). Desire to achieve a purified soul and religious excellence has created "a physical and psychological ambience where the signs of God and His omnipresence are manifested everywhere" (Tun Raja Uda et al., 1997, p. 297). Malay calligraphic tradition is seen as a practical means for the Malays to know and understand the religion of Islam.

Malay traditional arts, like Islamic arts, vary widely in their application. Islamic art is not restricted to calligraphy, arabesque and music (Burkhardt, 2009). As an example, during the Sultanate of Demak, the "Nine Saints" (the *Wali Sanga*) used the Malay expressive art of shadow play to propagate Islam through Sufi methodologies (Tun Raja Uda et al., 1997). The application of arts in the shadow play includes a verbal narrative as well as visually appealing characters. Religious phrases and characters are embedded in the shadow play performance. Uda and Al-Ahmadi (1997) write that the "Wali Sanga made changes in the presentation of the puppets in mixing flora shaped in human forms with elongated body and limbs to emphasise the imperfection of man's creation" (p. 342). The changes made were due to restrictions on the use of human images as symbols in the Islamic faith (Burckhardt 2009; Ernst, 2003; Goitein, 1966). Nevertheless, the art form enabled the audience to perceive the message behind the art.

Ibn Khaldun emphasises that art produces the quality of "sensual perception" and carries a spiritual message that can be perceived, felt and experienced (Rosenthall, 1958). Sufi scholars introduced a traditional concert performance to Malay arts from the Sufi practice of *sama* (Tun Raja Uda et al., 1997). *Ratib Saman* is an example of a traditional concert, usually performed at celebrations of festivities and weddings while simultaneously educating the attendees.

Tun Raja Uda affirms that *zikir*, a Sufi practice, is absorbed into the cultural life of the Malays. *Zikir* "denotes the devout invocation and repetition of the holy Name of God, either alone or enshrined in some formula" (Tun Raja Uda et al., 1997, p. 349). Uda explains that for Malay "men and women who perform the zikir, the spiritual power of music is the rhythmic chanting of the name of Allah" (Tun Raja Uda et al., 1997, p. 350). The chanting

during the performance relates to the greatness of Allah and offers general advice on good conduct (Tun Raja Uda, 1997).

According to Gallop (1994) and Uda and Al-Ahmadi (1997), the strongest influence on the Malays is the calligraphic script. They conclude that "calligraphy have made the objects not only being distinctively Islamic in nature, but also, exudes the powers associated with it" (Tun Raja Uda et al., 1997, p. 351). Uda et al. (1997) highlighted that the artistic application of calligraphy can be found in all areas of Malay arts and crafts. Therefore, in my design project, calligraphy had to be one of the main visual identities for my application prototype.

The Malay identity that I wish to achieve includes a variety of calligraphic designs, composition and colours. Uda and Al Ahmadi (1997) believe that the Malay arts are an embodiment of "enriched designs and motifs from a tradition based on natural phenomena to that entrenched in philosophical interpretation of the universe and life in general" (p. 351). Uda concludes that

> Islam had spread to the Malay Archipelago and had since then left an indelible mark on the rulers, as patrons of the art, and the ruled, as makers of artistic expression. The fusion and the merging between the indigenous traditional arts and Islamic aspirations had led to a rich legacy of Malay arts and crafts. (p. 351)

2.2.3 The Malay user-interface

Yaacob, Zainab, Mahmud and Nasir (2001) state that "the use of Jawi Malay scripts … [has] dwindled at an alarming rate and [Jawi] is considered to be an endangered script" (p. 2). This statement alerted scholars from Malaysia, Brunei and South Korea to the importance of reviving the use of Jawi script in the Malay language. Citing Muhammad

Muni'im and Haliza, Yaacob et al. (2001) point out that few Malays are Jawi literate, and "the situation is exacerbated by the wide availability of Romanised word processing software that can easily accommodate Rumi Malay (Romanised Malay)" (p. 3). McCabe (2011) expresses a similar view when he states that "Jawi continued to decline rapidly as a source for information, innovation and communication in post-colonial Malaysia", adding that "in contemporary Malaysia, Jawi has nearly disappeared as a system for disseminating information and innovation" (p. 41).

Situating a Jawi-based Malay user interface within a focused online environment should encourage the use of Jawi among the target user group. The Cyber Islamic Environment (CIE) (Bunt, 2000) is an umbrella term that can refer to a variety of contexts, perspectives and applications of online media by those who define themselves as Muslims (Bunt, 2003), Bunt examines the many functions of the CIE. The visual similarity between Jawi and Arabic, as well as the fact that most Malays are Muslims, enables users of the CIE to understand the visual as well as textual content of my project.

In the context of my project, the Jawi script and the content can be identified within the Muslim contexts. Bunt (2003) explains that the CIE has "the potential to transform aspect of religious understanding and expression within Muslim contexts" (p. 5); it also provides a platform for the "propagation and identity for Muslim individuals and organisations" (p. 5). Although my project focused on the cultural aspects of the Malay user, the understanding and identity promulgated within the CIE provided a reference point to better understand the design requirements.

Bunt (2009) highlights elements of specific Muslim world-views and notions of exclusivity, combined with regional and cultural understandings of online media and their validity. Bunt (2003) regards the CIE as a way to "delineate the Islamic Internet landscape"

(p. 5). He explains that he uses it in the sense of a space where Islamic beliefs form an identity reference point, however marginal, secular or religious (Bunt, 2003). This reference point has obvious utility for creating design elements suitable for the Malay user.

Bunt's research focuses mainly on the fundamentalist aspect of Islam on the internet. By his own admission, he has not explored in detail the role of the CIE in presenting Islamic art, or what he calls the "quieter forms of traditional… Islamic understanding" (Bunt, 2009, p. 25). Carl Ernst notes that expanding the scope of research within the CIE would prevent the presentation of "one-sided and distorting material" by extremists and eccentrics. Similarly, the rich visual elements of my Tirta Nirmaya prototype are intended to ignite the interest of the youth in Malaysia to explore arts and culture rather than extremist schools of thought.

Efforts are being made to revive Jawi; for example, Malaysia's Ministry of Education has introduced the teaching of Jawi script in public primary schools (Yaacob et al., 2001). The Department of Islamic Development Malaysia has also made it its mission to "increase the reverence and acceptance of the Jawi script by using information technology as an enabler" (Yaacob et al., 2001, p.4). The awareness and usage of Jawi is not limited to Malaysia; efforts to sustain literacy in Jawi are also underway in Brunei. Malaysia has also produced applied research projects such as JAWINET (Yaacob et al., 2001); the JAWINET homepage has resulted in the creation of research laboratories in University Malaya and the Management Science University of Malaysia. The Jawi Portal project (www.k-jawi.gov.my) is led by Malaysia's Ministry of Information, Communications and Culture, and was a case study in my research.

To date, no published research exists on the Jawi script as a user-interface element. Nevertheless, there are ample academic proofs of the fusion between traditional Malay art and Islam (Tun Raja Uda, 1997). Two seminal papers on the subject are “The Muslim User-interface Evaluation Framework” (Wan Mohd Isa et al., 2006) and “The Website User-interface Characteristics for Multi-Racial Settings in Malaysia” (Nasrul et al., 2012). The findings in these papers underpin the user-interface design methodology of my creative project.

2.3 Conclusion

In this chapter, I reviewed a wide range of literature relating to user usability and user-interface design, and analysed globally specific guidelines and processes in user-interface design. I covered theoretical and practical frameworks for a process guideline for the development of a localised user-interface with design elements based on the Jawi script. The theoretical and practical frameworks served as the foundation of my application development methodology.

Analysing the guidelines for user-interface design was a crucial first step in formulating a strategy to develop the application. I also reviewed literature that gave clues to the integration of Malay culture and arts in user-interface design.

In the following chapter, I explore Marcus’ guidelines on the critical aspects of globalisation for the user-interface design process in greater detail to inform the conceptual and critical framework of my project.

CHAPTER 3: CONCEPTUAL FRAMEWORK

According to Aaron Marcus, what factors are important in designing a localised user-interface?

In Chapter 2, I observed that the international and cultural requirements of the target user group are important in the design process. Marcus' understanding of the dimension of culture in designing user-interfaces, which underpins his theory in the field of Computer-Human Interaction, is of great relevance to my research. Designers, as well as developers of interactive applications, are now expected to apply these strategies in the design process. Moreover, the United Nations' Universal Declaration of Human Rights requires sustainable development of applications that are accessible to all.

This raises the issue of how to effectively design a user-interface in the context of a certain culture, in my case, in the Malay culture, whose Jawi script is dwindling in use and requires reviving. Simultaneously finding a conceptual framework to design an as-yet non-existent typographical font to manage interface presentation of the Jawi script. Therefore it is important to understand the specific guidelines related to globalisation in user-interface design and how it is applied to the field of Computer-Human Interaction (CHI).

Listed as a Master Graphic Designer of the 20th Century in the Icograda (International Council of Graphic Design Associations, now Ico-D) Graphic Design Hall of Fame, Aaron Marcus is notable for his efforts in creating user-interface guidelines for multicultural and international projects, such as the Green Machine project (http://bit.ly/GreenMachineProj). Marcus (2012) asserts that products and services have to be appropriately localised, translated and designed for specific markets. His user-interface design and consulting company, Aaron Marcus and Associates, Inc. (AM+A) was one of the world's first computer-

based design firms. Marcus proposed seven globally specific guidelines for user-interface design.

In this chapter, I explore Marcus' guidelines for user-interface design, and discuss Marcus' definitions of globalisation, internationalisation and localisation. According to Marcus, achievement of a consistent user-interface and satisfying user experience requires the understanding of his guidelines. These guidelines for user-interface design formed the conceptual framework of my research.

3.1 Globalisation, Internationalisation and Localisation according to Aaron Marcus

Aykin (2005) observes that the world is a diverse place, and that this diversity needs HCI applications that match it. Marcus and Gould (2012) assert that "globalisation refers to the entire process of preparing products and services for worldwide production and consumption" (p. 344). Al-Rodhan and Stoudman and Aykin have postulated similar globalisation theories. Marcus and Gould, as well as Aykin, recommend that a process is required to create consistent user-interfaces and satisfying user experiences.

Internationalisation, translation and localisation are factored into the process of globalising the design of software and web applications. Marcus (2012) notes that the process requires the understanding of issues faced by different cultures; he explains that this requires analysis at international, intercultural and local levels. This process relates to the functionality of the software or applications.

Developing software for different users and localities could involve the collection and use of large amounts of data and resources. Marcus explains that internationalisation, translation and localisation is a process of preparing code that will separate data and

resources. He further asserts that the process prevents the user-interface being restricted to one particular platform or geographic region (Marcus, 2002, 2005; Marcus & Gould 2012). This eliminates unnecessary clutter of data and resources for a particular target user group.

According to the Localization Institute, “internationalisation is a way of designing and producing products that can be easily adapted to different locales” (Retrieved 2015). Marcus insists that internationalisation is a requirement due to geographic, political, linguistic and typographic differences between nations or group of nations. In the context of multicultural Southeast Asia and Australia, the process can be applied to websites and mobile applications. These websites and applications may target an audience with various religious, dialectic, aesthetic or other humanistic issues of particular importance (Marcus & Gould, 2012). Therefore this process may include single design elements with which the users are familiar.

Marcus points out that internationalisation requires translation from one language to another. Marcus and Gould (2012) explain that “the International Standards Organisation (ISO) has developed a number of software, hardware and human factors standards in an effort to establish international standards for some parts of a user-interface” (p. 334). Assimilation and communication with local cultures are more important now than ever. Google Translate is an example of an accessible translation tool derived from ISO development to establish standards without expensive and tedious customisation.

In view of internationalisation that may exist while using a web or software application, a level of localisation is required (Marcus, 2007, 2009; Marcus & Gould, 2012). Morry Sofer (2006) describes localisation as “the process of creating or adapting a product to a specific locale that is to the language, cultural context, conventions and market

requirements of a specific target market" (p. 56). Marcus and Gould affirm that significant localisation depends on the degree of cultural differences between target audiences in specific situations (Marcus & Gould, 2012). An application for a specific small-scale community or cross-national ethnic region (united by language and culture) is an example of a situation that requires the dimensions of culture to be understood (Marcus & Gould, 2012).

3.1.1 Explaining Hofstede and Trompenaar's Dimensions of Culture

As observed in Chapter 2, Hofstede (1991) and Trompenaar (1998) provide a cultural model for how meaningful data can be used to understand the communication preferences of a particular culture. Marcus and Gould indicate that Hofstede and Trompenaar were "able to determine patterns of similarities and differences" from analysing large data sets (Marcus & Gould, 2012). Marcus and Gould (2012) claim that Hofstede and Trompenaar's monumental data collection from surveys and interviews conducted over 53 countries and thousands of IBM employees provides substantial usable and valid information. Hofstede and Trompenaar's data analysis has given researchers and designers "in the fields of managements and intercultural and organisational communication" valuable set of data variables (Marcus & Gould, 2012)

Cultural theorists such as Hall (1976), Hofstede (1998) and Trompenaars (1998) are in favour of understanding problem-solving patterns from the cultures they researched. Marcus and Gould (2012) agree that Hofstede's "focus was not on defining culture as refinement of the mind but rather on essential patterns of thinking, feeling and acting that are well established during childhood" (p. 355). They further explain that these patterns result "in a culture's choices of symbols, heroes/heroines, rituals and values" (Marcus &

Gould, 2012). Hofstede's cultural data, gathered and analysed by himself, Marcus, Gould and many other researchers, have given opportunities for designers to create systems intended for specific user groups.

Hofstede's Dimensions of Culture, through regulated empirical research data, consist of power distance (PDI), collectivism/individualism (IDV), femininity/masculinity (MAS), uncertainty avoidance (UAI) and long-term/short-term time orientation (LTO). Marcus and Gould (2012) summarise the implications of Hofstede's Dimensions of Culture for user-interface design and give illustrations of characteristic websites. The Dimensions are useful in determining the design rules specific to the preferences of the Malay user. The following sections show how Marcus and Gould (2012) explain Hofstede's Dimensions of Culture.

1. **Power Distance (PDI)**

   PDI refers to the extent to which less powerful members expect and accept unequal power distribution within a culture. (Marcus & Gould, 2012, p. 355)

i. Access to information: highly structured versus not as highly structured

ii. Hierarchies in mental models: tall versus shallow

iii. Emphasis on the social and moral order (e.g., nationalism or religion) and its symbols: significant/frequent versus minor/infrequent use

iv. Focus on expertise, authority, certifications, and official logos: strong versus weak

v. Prominence given to leaders versus citizens, customers or employees

vi. Importance of security, restrictions, or barriers to access: explicit, enforced, frequent restrictions on users versus transparent, integrated, implicit freedom to roam

vii. Social roles used to organise information (e.g. A managers' section that is obvious to all but sealed off from non-managers)

viii. Acceptance of website censorship; reduced concern with privacy within social media. (Marcus & Gould, 2012, p. 358)

2. Collectivism/Individualism (IDV)

Individualism in cultures implies loose ties; everyone is expected to look after one's self or immediate family but no one else. Collectivism (low IDV) implies that people are integrated from birth into strong, cohesive groups that protect them in exchange for unquestioning loyalty. (Marcus & Gould, 2012, p. 358)

i. Motivation based on personal achievement: maximised (expect the extraordinary) for individualist cultures versus underplayed (non-competitive and internal) for collectivist cultures

ii. Images of success demonstrated through materialism and consumerism versus achievement of social, religious, or charitable agendas

iii. Rhetorical style: direct, controversial/argumentative speech and tolerance or encouragement of extreme claims versus indirect (apparently vague) speech, official slogans, harmony, modesty and subdued controversy

iv. Prominence given to youth and action versus to aged, experienced, wise leaders and contemplative states of being

v. Importance of individuals; products shown in use by single person versus proud to shown by themselves or used by groups

vi. Central area of focus versus contextual images that place objects against a background

vii. Underlying sense of social morality: emphasis on rules and absolute truth versus emphasis on relationship and ethics of care

viii. Emphasis on change: what is new and unique versus what constitutes tradition and maintains historical trends

ix. Willingness to provide personal information to all versus sharply defined in-/out-groups (sharing of information with the in-group and protection of personal data from the out-group). (Marcus & Gould, 2012, p. 358)

3. Femininity/Masculinity (MAS)

Masculinity and Femininity (low MAS) refer to gender roles, not physical characteristics. (Marcus & Gould, 2012, p. 358)

i. Traditional gender/family/age distinctions; clothing and personal appearance of men and women expected to be strongly differentiated

ii. Focus given to masculine accomplishment

iii. Work tasks, roles, and master, with quick results for limited tasks

iv. Navigation oriented to exploration and control

v. Attention gained through games and competitions; games have winners and losers

vi. Graphics, sound, and animation use for utilitarian purposes

vii. Blurring of gender roles; clothing and personal appearance of men and women often androgynous

viii. Mutual cooperation, exchange and support (vs. Mastery and winning)

ix. Attention gained through visual aesthetics, appeals to unifying values, poetry, images of nature. (Marcus & Gould, 2012, p. 359)

4. Uncertainty avoidance (UAI)

People vary in the extent to which they feel anxiety about uncertain or unknown matters, as opposed to the more specific feeling of fear caused by known or understood threats. Cultures vary in their avoidance of uncertainty, creating different

rituals and having different values regarding formality, punctuality, legal-religious-social requirements, and tolerance for ambiguity. (Marcus & Gould, 2012, p. 359)

i. Simplicity, with clear metaphors, limited choices and restricted data; high-UI websites would give users far fewer check to help them avoid making errors

ii. Attempts to reveal or forecast results of actions before users act

iii. Navigation schemes intended to prevent users from becoming lost: use of "bread crumbs" and other methods help keep users situated

iv. Mental models and help systems that focus on reducing "user errors"

v. Redundant cues (colour, typography, sound, etc.) to reduce ambiguity; lower information density

vi. Complexity with maximal content and choices; low-UA websites will give power users much more flexibility

vii. Acceptance (even encouragement) of wandering and risk, with a stigma on "over-protection"

viii. Less control of navigation; for example, links might open new windows leading away from the original location

ix. Mental models and help systems might focus on understanding underlying concepts rather than narrow tasks

x. Coding of colour, typography, and sound maximise information to provide greater information density. (Marcus & Gould, 2012, p. 359)

5. Long-term/short-term time orientation (LTO)

i. Content focused on experience-based knowledge, practice and practical value

ii. Relationships as the main source of information and credibility

iii. Patience in achieving results and goals

iv. Content focused on analytic knowledge, logical truth and strong claims and assertions

v. Rules and logic as the basis of information and credibility

vi. Desire for immediate results and achievement of goals. (Marcus & Gould, 2012, p. 360)

Cultural data may not provide absolute understanding of a target culture but will provide valuable information for designers seeking to create products for their target user group. Marcus and Gould (2012) maintain that "not everyone in a society fits the cultural pattern precisely, but there is enough statistical regularity to identify trends and tendencies" (p. 360). Gould et al. (2000) concur, and insist that the "chaos" created by the wide variations in target user groups is manageable from the cultural data that has been collected. In the context of Malaysia, the cultural data collected by Gould et al. (2000) and Nasrul et al. (2012) is a valuable complement to Marcus' specific guidelines that address the critical aspects of globalisation in the user-interface design process.

3.2 Globally Specific Guidelines in User-Interface Design

Marcus and Gould (2012) state that "the globalised user-interface development process is a sequence of partially overlapping steps, some of which are partially overlapping

steps, some of which are partial or completely iterative" (p. 347). These iterative steps can be dynamic in nature. Shneiderman and Plaisant (2010) assert that "in every creative domain, there can also be discipline, refined techniques, wrong and right methods, and measure of success" (p. 102). In order to manage the inherently creative and unpredictable design methodology, they recommend the *Guideline Documents and Process* (Shneiderman & Plaisant, 2010).

Marcus and Gould recommend that a set of working guidelines be applied in the initial stage of the design process (Marcus 2011; Marcus & Gould, 2012). Here, Shneiderman and Plaisant (2010) claim that "experience has shown that each pillar can produce an order-of-magnitude speed-up in the process" as well as "facilitate the creation of excellent systems" (p. 102). They also contend that software projects depend on the precision and completeness of available guidelines and processes from users and implementers (Shneiderman & Plaisant, 2010). Subsequently, Marcus and Gould produced a set of steps in the process of user-interface design and development (Marcus, 2011; Marcus & Gould, 2012).

Marcus and Gould refer to their design steps as a high-level user-interface development process. They recommend the following steps: plan, research, analyse, design, implement, evaluate, document, maintain and train (Marcus, 2006, 2011; Marcus & Gould, 2012). Marcus also recommends a guideline to assist designers and developers in preparing a checklist for specific tasks. The guidelines for the high-level user-interface development process are: user demographics, technology, metaphors, mental models, navigation, interaction and appearance (Marcus 2006, 2011; Marcus & Gould, 2010).

Marcus' guidelines are presented and explained in the following sections.

3.2.1 Marcus' First Guideline: User Demographics

Marcus (2011) describes culture as "large-scale group behaviours (rituals), leaders/followers, values, artefacts and signs" (p. 2). He also asserts that "many culture models exist as bases for analysis, design and evaluation" (p. 2), and that "cultural analysis is related to semiotics/semiologic, the science of signs, which asks what do things mean" (p. 17). The meaning will be identified through the designer and the target user populations (Marcus, 2006).

Marcus and Gould (2012) describe user demographics as "a process to identify national and cultural target user populations and segments" (p. 348). This identification allows for the need to differentiate user-interface components (Marcus, 2011; Marcus & Gould, 2012). They believe that based on common attributes in the target user groups, user-interface component can be reused. The identification of common attributes saves time and cost in development, as well as providing a viable and acceptable user-interface component (Marcus & Gould, 2012). Marcus and Gould (2012) explain that the common attributes that may exist in a target group are "religion, privacy, intellectual property, spamming, defamation, pornography and obscenity, vandalism (e.g., viruses), hate speech, fraud, theft, exploitation and abuse (children, environment, elderly, etc.), legal jurisdiction, seller/buyer protection, and so on" (p. 348).

Marcus, Armitage, Frank and Guttman (1999) summarise user demographic as follows:

> *By managing the user's experience with familiar structures and processes, the user's surprise at novel approaches, as well as the user's preferences and expectations, the user-interface and information-visualization (UI+IV) designer can achieve compelling forms that enable the user-interface to be more usable and acceptable.* (p. 2)

For Shneiderman and Plaisant (1998), understanding users is a simple idea but in practice it is difficult and often undervalued. Therefore, Shneiderman and Plaisant (2010) recommend that "all designs should begin with an understanding of the intended users, including population profiles that reflect their age, gender, physical and cognitive abilities, education, cultural or ethnic backgrounds, training, motivation, goals and personality" (p. 62).

Nasrul et al. (2012) identify the cultural and social structure of status and rules in Malaysia's educational website design, noting the use of axial symmetry, prominent display of logos and seals, images of rulers and dignitaries, monuments and achievements. Marcus and Hamoodi (2009) identified similar characteristics in their study of Arabic users of educational websites. In my project, user demographics need to be identified to ascertain the national or cultural attributes required for the user-interface design. The main goal is to provide the target Malay user with usable, useful and appealing design.

3.2.2 Marcus' Second Guideline: Technology

According to the sociologist Read Bain (1937), technology means "…all tools, machines, utensils, weapons, instruments, housing, clothing, communicating and transporting devices and the skills by which we produce and use them" (p. 860).

For Shneiderman (2003), the meaning of technology means is not important. Instead, he believes that technology developers must strive to understand what the user wants. He advocates that in the modern high-tech world, "new computing must be innovative, and it must focus on raising user satisfaction, broadening participation, and supporting meaningful accomplishment" (Shniederman, 2003, "Inspiration For The New Computing", para. 5). Understanding the evolution of technology requires the developer to design and develop according to the target users' requirements (Shneiderman, 2003).

Marcus and Gould (2012) argue that technology developers need to determine "appropriate target user categories" including "sound, visual, or three-dimensional tactile media; verbal versus visual content; and so on" (p. 348). Marcus and Gould (2012) identify languages, scripts, fonts, colours and file formats as technology categories and recommend that research be undertaken before producing software for code development and content management systems.

Marcus (2006) believes that "in an era of instant, global media, culture is always being affected and evolving" (p. 17). New products and services exist because of new technologies and advanced internet connections (Marcus, 2007). He raises the idea of "the Web…becoming mobile" as an example, explaining that mobile technologies "such as PDA, mobile phones and smart phones have ever-improving web-browsing capabilities" (p. 927).

Similarly, Marcotte observes that the number of web-enabled devices worldwide has increased massively in recent years. In a design context, Marcotte (2011) asserts that "we can design for an optimal viewing experience, but embed standards-based technologies into our designs to make them not only more flexible, but more adaptive to the media that renders them" (p. 49). He coined the term "responsive web design" to reflect these advancements in technology.

The World Wide Web consortium (w3.org) acknowledges the advent in web technologies and devices at the international level. It supplies an array of resources for web developers and designers, including standardised ASCII codes for Asian fonts for the web and layouts for different cultures. In my project, I had to identify appropriate technology for the target Malay user community to use in the design and development process.

3.2.3 Marcus' Third Guideline: Metaphors

Marcus and Gould (2012) states that "metaphors are substitutes for computer related elements" explaining that metaphors are "essential concepts conveyed through words and images, or through acoustic or tactile (haptic) means" (p. 343). He elaborates that metaphors "help user understand, remember and enjoy entities and relationships of computer-based communication systems" (Marcus & Gould, 2012, p. 343). Therefore, as a user-interface component, a metaphor reflects a real-world item or meaning that characterises interaction (Marcus & Gould 2012).

Marcus (2005) acknowledges that "metaphors can be overarching, or they can communicate specific aspects of user-interfaces" (p. 943). For Marcus and Gould (2012), designers need to "determine optimum minimum number of concepts, terms and primary images to meet user needs" (p. 348). As an example, the "trash can" image can easily be understood universally as a metaphor for deleted files on the desktop computers. Marcus believes that understanding the target communities is fundamental to effectively communicating specific effects of user-interfaces (Marcus, 2005; Marcus & Gould, 2012).

Marcus (2005) asserts that understanding target user communities is important because differences in language and culture can cause miscommunication and misunderstanding. As an example, the image of a house can be interpreted as the home button in a website; the image can be a two-dimensional "flat design" illustration or a three-dimensional skeumorphic image. Both images can be interpreted differently by target users, depending on their cultural background as well as geographic location (Marcus, 2011).

Marcus also believes that the adjustment of methodical images is necessary for target users, and that further development in Natural User-interface can be done with accessible technology. He states that the nature of further development will depend on the national and cultural attributes of the target users (Marcus, 2005, 2007, 2011; Marcus & Gould, 2012). Understanding the data, information and accessible technology of the target Malay user population was useful for me in designing the user-interface aesthetics for my project.

3.2.4 Marcus' Fourth Guideline: Mental Models

A mental model is defined as the "organisation of data, functions, tasks, roles and people in groups at work or play" (Marcus & Gould, 2012, p. 343). Similar to user models or task models, the mental model is "learned and understood by users and … reflects the content to be conveyed, as well as the user tasks" (Marcus & Gould 2012: p. 343). In the HCI field, Stuart Card, Jonathan Grudin, Ben Shneiderman, Ewa Callahan and Nuray Aykin refer to mental models as information visualisation or information organisation. Therefore, per Marcus and Gould (2012), the "mental model is intended to convey the organisation observed in the user-interface itself" (p. 343).

In terms of the user tasks, Marcus and Gould (2012) recommend that there is a need to "determine the optimum minimum varieties of content (information) organisation" (p. 343). They urge developers to consider how hierarchies may need to change and to consider the overall depth and breadth of the hierarchies (Marcus & Gould, 2012). Marcus and Gould reiterate that optimum variety can depend on the understanding of the target users.

Marcus and Gould (2012) affirm that culture can affect the cognitive style of mental models. For example, as cited by Marcus and Gould (2012), Masuda and Nisbett have observed that Asians are more focused on the relationships between elements while Westerners are more focused on central objects. It is beyond the scope of this project to corroborate the Asian-Western cognitive style. It is sufficed to highlight that Marcus and Gould refer to two cognitive perspectives defined by Nisbett and Norenzayan (p. 348) as:

1. *Holistic thought,* which is based on orientation to context and the field as a whole. Experience-based knowledge with the acceptance to change and multiple perspectives are preferred. This is more common in East Asia where there are links to personal interdependence.

2. *Analytic thought* involves an object being decontextualised, categorical thinking, rule-based logic and contradictions being rejected. This is more common in Europe and North America, where there is personal independence (Marcus & Gould, 2012).

Ewa Callahan (2005) agrees that there are "culturally motivated differences" by working on the "information organisation data", observing that the most visible criterion is page orientation, i.e. horizontal versus vertical layout. Marcus (2009) notes that websites from Austria and Denmark have a preference for horizontal layout design, whereas those from Japan and Malaysia have a preference for vertical layout design. Such differences suggest that content management from a culturally motivated cognitive perspective may miscommunicate information.

Edward Hall, in his study of culturally motivated cognitive perspectives, notes that some cultures "tend to favour either high or low context communication" (Hall, YEAR cited in

Marcus & Gould, 2012, p. 349). Marcus and Gould (2012) explain that high-context communication contains messages that are non-verbal, direct, and embedded in the social and physical context of the interaction, whereas low-context communication contains messages that are verbal, direct and stand on their own. Understanding the culturally motivated perspective of the mental model within the target audience may result in a more accessible navigation design.

3.2.5 Marcus' Fifth Guideline: Navigation

According to Marcus (2009), navigation is a "technique of moving through the mental model" (p. 387). Marcus and Gould (2012) assert that "the term implies dialogue and process, as opposed to structure" (p. 343). The dialogue and process of moving through the mental model includes "links, buttons, dialogue boxes, panels and windows" (Marcus, 2009, p. 387). The focus is on sequences of action to access dynamic content as opposed to static ones (Marcus & Gould, 2012).

Marcus and Gould (2012) highlight the need to determine the various types of navigation, as the purpose of "navigation variation (is) to meet target user requirements, determine cost-benefit and revise as feasible" (p. 349). They note that studies by Dong (2007) show significant differences in navigation of websites with the same layout but different geographical locations, languages and scripts (Marcus & Gould, 2012). This implies that the culture of the target users influences the navigation design.

Callahan (2005) and Nasrul et al. (2012) have found that cultures differ in navigation preferences. For example, Callahan (2005) notes that websites in Malaysia have more links in the body of the pages, while websites from Denmark or Sweden have multiple-layer

menus. Within Malaysia, Nasrul et al. (2012) observe that the Malays prefer icon-based menus with text labels and the Chinese prefer only icon-based menus.

3.2.6 Marcus' Sixth Guideline: Interaction

Interaction is the set of "techniques of input, output and the overall behaviour of the systems" (Marcus, 2009, p. 387). Marcus and Gould (2012) further define interaction as the "means by which users communicate input to the system and the feedback supplied by the system" (p. 343). They note that the means of interaction can be divided into two aspects:

1. *Command-control devices,* which include hand/finger gestures, keyboards, mice, joysticks, microphones and so on.

2. *Sensory feedback,* which includes changes of state of virtual graphical buttons, auditory displays and tactile surface.

Marcus and Gould (2012) believe that the interaction techniques required vary among target user groups. They highlight the need to "determine optimum minimum variations of input and feedback" (p. 349), noting that countries with slower internet speeds require versions with minimal graphics. They suggest that text labels be used in a case of low loading graphics (Marcus & Gould, 2012). The variation in interaction will mainly depend on the feedback required by the target user group (Marcus & Gould, 2012).

Jonathan Duckworth (2012) echoes the notion that feedback can be provided to users in order to realise a goal or action. His research highlights differences in technical as well as education abilities that might affect the type of feedback provided. He gives an example of modifying audio-visual feedback to maintain user interest (Duckworth, 2010). Determining a suitable variation to the interaction is fundamental within a target user group

(Marcus & Gould, 2012). In relation to my project, the differential user feedbacks may be applied to the navigation through verbal and visual representation.

3.3.7 Marcus' Seventh Guideline: Appearance

According to Marcus (2009), appearance is the "visual appearance characteristics" (p. 387). Marcus and Gould (2012) note that appearance "implies all aspects of visible, acoustic and haptic languages, as well as the level of abstraction or realism in graphic imagery" (p. 343). Examples of appearance include "typography, colour, layout, sequencing; verbal characteristics, tactile characteristics, sonic characteristics, and aromatic characteristics" (Marcus, 2009, p. 387). Marcus believes that there is a need for appearance variations within a target user group (Marcus, 2009; Marcus & Gould, 2012), and to "determine optimum minimum variations of visual and verbal attributes" (Marcus & Gould, 2012, p. 349). Variations exist in:

1. *visual attributes,* which include layout, icons, and symbols, graphics, typography, colour and general aesthetics, and
2. *verbal attributes,* which include language, formats and ordering sequences.

For example, Marcus and Gould (2012) note that written Asian languages contain symbols with many strokes. They suggest that "this factor seems to lead to an acceptance of higher visual diversity of marks in complex public information displays than is typical for Western countries" (p. 349).

For Marcus (2009), "colour is an essential characteristic of appearance that is influenced by culture" (p. 392). Callahan (2005) echoes this, stating that almost all websites he/she researched use national or cultural colours as preferences for colour schemes. For

example, according to Marcus (2009), Arabs have a preference for blue and green visual communication, while Callahan (2005) noticed that a white background is common for Malaysian and Swedish websites. Other visual or verbal attributes can be similarly influenced by the culture of the target group (Marcus, 2009, 2011; Callahan, 2005).

Marcus points out that culturally diversified user groups treat websites as a visible representation of their values and culture (Marcus, 2009). Marcus observes that Arabic-based websites typically feature prominent name banners, logos and seals, as well as people of Arabic culture (Marcus, 2009). Nasrul et al. (2012) observed that native Malays prefer to use images of people with their online activities. Marcus, Callahan and Nasrul and colleagues agree that the appearance of websites for different target users is important for an accurate representation of values and culture.

3.4 Conclusion

To conclude, in this chapter, I explored Aaron Marcus' conceptual framework for critical aspects of globalisation of the user-interface design process. I note that there exists a globalisation strategy based on notable academics such as Al-Rodhan, Stoudmann, Aykin and Marcus himself. I also identify that the globalisation strategy includes the process towards satisfying target user experiences. Most importantly, the project may also have wider implications for the understanding of globalised media, particularly in relation to specialised language and culture group. Therefore, the standardisation process is in line with what International Standards Organisation (ISO) has set for globally specific guidelines for user-interface design.

Marcus' guidelines involve some overlapping steps and various developmental strategies. There are numerous instances of complicated developmental steps and

strategies related to target cultural groups as well as technologies. Nevertheless, Marcus, Shneiderman and their associates have highlighted the numerous culturally diversified design process and expected outcome. Generally speaking a disciplined and refined set of design guidelines facilitates better user experiences.

Identifying the demography and available technology of a target user group are the initial steps of a guided and disciplined design process. I could relate to Marcus' notion of metaphors, mental models, navigation, interaction and appearance to the process of designing a user-interface. Marcus' guidelines provide a feasible design framework for me to design a sustainable culture-based user-interface.

In the following chapter, I analyse a Jawi-based website according to Marcus' guidelines. The small number of existing full Jawi-based websites may provide methodological challenges. The current and only Jawi-based user-interface components of the website present design and development challenges. The main focus for analysis was its online presence and the verbal attributes of the Jawi script within the modern Malay language. The case study was undertaken to provide direction for my own design methodology.

CHAPTER 4: CASE STUDIES

In analysing the case studies, how can Aaron Marcus's theories be effectively implemented in a localised user-interface?

In Chapter 3, the primary aim in understanding Aaron Marcus' process was to identify specific guidelines on the critical aspects of globalisation for user-interface design. These guidelines involve a variety of developmental as well as localisation strategies, and include the identification of user demographics and available technology, metaphors, mental models, navigation, interaction and appearance. In this chapter I investigate how Aaron Marcus' theories can be effectively implemented in a localised user-interface.

I noted in earlier chapters that very few websites or applications feature user-interface and content fully in Jawi script for Malay users. Thus, the revival of Jawi thus presents design process and methodological challenges. As noted previously, Mashkuri Yaacob, Tan Sri Dr Rais Yatim and Prince Abdul Malik of Brunei have encouraged the revival of Jawi usage through modern media forms. In the light of the unavailability of a full Jawi-based website or application, I address the question of how Aaron Marcus' theories can be effectively implemented in a localised user-interface by analysing a website, the Jawi Portal, established by the Malaysian Government using Jawi script, and supplementing it with the technical construct of Qatar's Information Technology (ictQatar) responsive website.

As no design guidelines for either the Jawi Portal or ictQatar, several approximations were made in the case study. Munster (2006) asserts that approximation is "a differential qualifier of the proximate gives us new ways to configure digital aesthetics" (p. 159). Thus, I

have formed a hypothetical reasoning of the sites through their visual representations and technical constructs, in reference to Marcus' specific guidelines.

4.1 Introduction

Since the early 2000s, Malaysian government initiatives and royal decrees have encouraged the revival of Jawi script (Ibid p. 6). Several Malaysian government ministries are attempting to increase the use of Jawi typography (Ibid p. 24) through multimedia technology. As an example, J-Qaf (Jawi, Al Quran, Arab, Fardhu Ain) was introduced to revive the use of Jawi in Malaysian schools. In 2008, the Ministry of Culture, Arts and Heritage introduced the Jawi Portal (Fig 4.1a), a web-based initiative intended to revive Jawi usage (unfortunately, in 2013 the website was taken offline without any official explanation).

The closing of the Jawi Portal may affect the process of reviving and sustaining the use of Jawi among Malay users. The target user group have some knowledge of the Malay language represented by the Jawi script. According to Malaysia's Department of Statistics (2012), in 2010, 71.2% of the population were Malays and were literate users of the Malay language. With the identification of the target group, my research is more focused in providing intellectual as well as practical hypothesis for the Malaysian government's push to revive the use of Jawi script in the Malay language.

Fig 4.1a The Jawi Portal

Despite the fact that 215 million people speak Malay, traditional Jawi script has been replaced by the more accessible Latin typography in post-colonial Southeast Asia (Ibid p. 23). I selected the Supreme Council of Information Communication and Technology for the Government of Qatar's ictQatar website (Fig 4.1b) for analysis, as it has a design framework that is close to the Jawi script (Arabic has similar writing methods). In the World Wide Web consortium (W3C) standards, Jawi script has coding rules similar to those for Arabic script. The ictQatar website represents a case study relevant to designs with right-to-left text and localised Arabic script. In view of the demise of the Jawi Portal, analysis of the technical construction of a responsive design framework for a website with right-to-left text (as used in Jawi, Arabic, Persian and Urdu) was helpful in the design of my project.

Fig 4.1b The ictQatar responsive website

4.2 The Jawi Portal and ictQatar

As noted earlier, the Jawi Portal was an initiative of Malaysia's Ministry of Culture, Arts and Heritage. Its purpose is given in the main body of the frontpage (Fig 4.2).

Fig 4.2 The purpose of the Jawi Portal visually presented in the Jawi script

Translation:

> *The Jawi portal is an interactive portal that is created through the full use of the Jawi language. It contains various features for users to navigate. The existence of this portal will enhance the value of knowledge for users of different age groups in learning and understanding the Jawi script. This portal serves many functions such as forums, articles, news and so on. It is hoped that users are able to optimally benefit from and apply what is presented. May this portal sustain and protect the Jawi script from disappearing with the passage of time.*

The purpose of the Jawi Portal is clearly to revive and sustain the use of Jawi script among the Malay users. The frontpage depicted in Fig 4.2 includes a globalisation process: the localisation efforts, together with the common website functions, are meant to educate and allow users to understand the Jawi script. Thus, the Jawi Portal indicates its main intention of reviving the use of Jawi script through a globalisation process.

According to Marcus, the functionality of a website's software and application is closely related to the globalisation process (Marcus 2006). The website design and coding process is evident in the Jawi fonts, as well as the mouse-over effect that transliterates the articles to Romanised fonts (Figs 4.3 a and b). The design and coding process follow the W3C internationalisation standards for right-to-left typography. The design and coding of the Jawi Portal illustrate a process that Marcus terms "the infusion of international and cultural requirements" (Marcus, 2010). The Jawi typography fits the cultural requirements and the Romanised mouse-over tooltip fits the internationally accessible requirements.

Fig 4.3a The mouse-over effect allow for a transliterated text in Romanised letters

Fig 4.3b Example of mouse-over effect that allows a transliterated description of links

The Jawi Portal utilised standard hypertext markup language (HTML), cascading style sheets (CSS) and Javascript (Fig 4.4a). As the coding for the Jawi Portal is outdated, I studied ictQatar's coding (Fig 4.4b) for right-to-left text orientation and modern devices. The design and development process adhered to the standards set by W3C for a localised user group.

```
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href="penghargaan1.jsp">ڤڠهرڬاءن</a> |  
                <a onmouseover="ddrivetip('Pendaftaran Ahli', 100)" onmouseout="hideddrivetip()" href="Registration.jsp"> اهلي ڤندفترن </a> |  
                <a href="images/setup.exe" onmouseover="ddrivetip('Muat turun tulisan jawi untuk paparan yang lebih baik di dalam portal jawi', 150)"
onmouseout="hideddrivetip()">موات تورون
توليسن جاوي</a></span></p></td>
        </tr>
        <tr>
            <td colspan="5">
            <img border="0" src="images/footer_btm_grey1.gif" width="100%" height="20"></td>
        </tr>
        <tr>
            <td width="11" background="images/colorkiri.gif"> </td>
            <td width="9" bgcolor="#FFFFFF"> </td>
            <td width="734" bgcolor="#FFFFFF">
              <div align="center">
                <object classid="clsid:D27CDB6E-AE6D-11CF-9688-444553540000"
codebase="http://download.macromedia.com/pub/shockwave/cabs/flash/swflash.cab#version=6,0,40,0" border="0" width="726" height="74">
                  <param name="movie" value="images/portalBanner.swf">
                  <param name="quality" value="High">
                  <param name="wmode" value="transparent">
                    <embed src="images/portalBanner.swf" pluginspage="http://www.macromedia.com/go/getflashplayer" type="application/x-shockwave-flash"
width="726" height="74" quality="High" wmode="transparent">
                </object>
```

Fig 4.4a The Jawi Portal codes

Fig 4.4b The ictQatar codes

4.2.1 Marcus' First Guideline: User Demographics

Marcus wrote that there is a need to understand the process of identifying national and cultural target user populations and segments (Ibid 85). Although the Jawi Portal was intended to "enhance the value of knowledge for users of different age groups in learning and understanding", the Portal was designed to target Malay-speaking Malaysians who recognise the Jawi alphabet but do not necessarily know how to read it. This is shown by the portal's provision of content and user-interfaces in full Jawi typography with Romanised Malay mouse-over tooltips. Although tooltips are available when users mouse over a link or a paragraph, there are no visible indications that tooltips are there or present for every word or sentence of the portal. This may have caused some internet users to disengage from the Jawi Portal.

According to the Malaysian Communications and Multimedia Commission and On Device Research, in 2014, 66% of the Malaysian population were Internet users. Unfortunately, very websites contain Jawi typography. The Jawi Script Learning Tool System

- http://www.ejawi.net (Fig 4.5a) and Utusan Melayu Managuan http://xtive.utusan.com.my/jawi/ (Fig 4.5b) are the most active current websites with some Jawi typography. The Jawi Script Learning Tool System has a typical portal design with Romanised Latin alphabets, while the Utusan Melayu Mingguan is an interactive magazine.

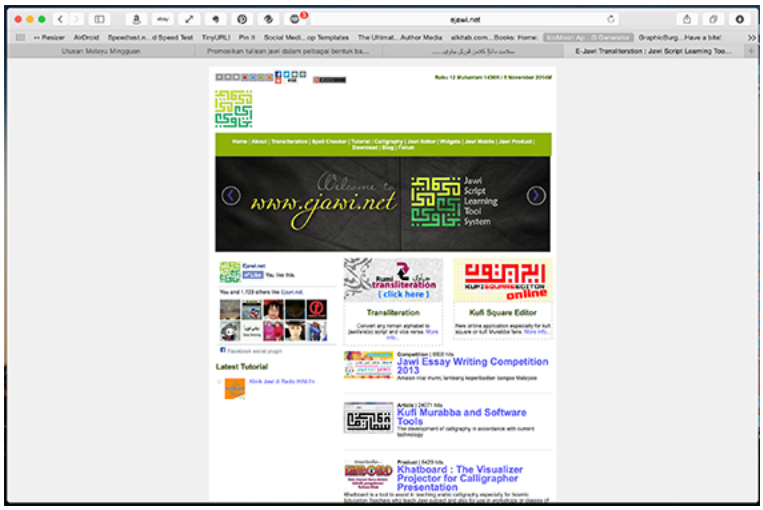


Fig 4.5a Homepage of eJawi. Retrieved from http://www.ejawi.net

Fig 4.5b Home of Utusan Melayu (Jawi). Retrieved from http://xtive.utusan.com.my/jawi/

The Jawi-related websites mentioned above have Latin typography-based structures typical of Google, Yahoo or Microsoft or an Internet-based interactive magazine. The Jawi Portal was created to give Malaysian Internet users an accessible website with which they are familiar. Due to the limited number of Jawi-based websites, the Jawi Portal managed to allow users to navigate a web interface that they understand. Thus, providing the user demographics something useful and useable.

As previously noted, many academics and designers, including Marcus and Shneiderman, insist on the importance of understanding the users and what is useful and useable to them. Nielsen mentions that the usability and usefulness of a user-interface have multiple components, namely, learnability, efficiency, memorability, errors and satisfaction. The Jawi portal appears to fail Nielsen usability requirements, especially learnability, which means easy learning of the user-interface. Malaysia's Malay-speaking internet users may have found the Jawi Portal's user-interface to be lacking in usefulness and usability.

In Chapter 5, I propose a user-interface designed to be more usable and useful for the target users, developed through an understanding of user demographics, cultural background and the user experience with available technology.

4.2.2 Marcus' Second Guideline: Technology

Although there are many definitions of the term "technology", Marcus and Gould identify it to mean the core application or web technical specifications (Marcus & Gould, 2012). Marcus, Gould, Shneiderman and Bain agree that technology is what we (developers and designers) produce for users to use. The Jawi Portal targeted Malay-speaking internet users with its web-based design and programming; it was written in HTML with some CSS.

There is also some dynamic HTML, which employs Javascript to enhance the functionality and style of normal HTML.

The Jawi Portal exhibited what Marcus terms high verbal content (Marcus 2006; Marcus & Gould, 2012). The Jawi Portal utilised HTML's ability to translate codes into any type of font that can be viewed on a website. Within the Jawi Portal, Jawi typography was used for the content and the main user-interface, including the title, headings, content and navigation. The Jawi Portal does not reflect Marcus' theory on high verbal content; instead it proves Oliver Reichenstein's contention that "95% of the information on the web is written language" (Reichenstein, 2006, 'Web Design is 95% Typography' , para. 1).

According to Marcus and Gould (2012), "the Web is becoming mobile" and technologies are becoming more accessible to users (p. 341). In 2012, 86.3% of mobile phone users in Malaysia were Malaysian and 61.1% of these were Malays who access mobile internet (Malaysian Communications and Multimedia Commission, 2012). However, the Jawi typography in the Jawi Portal was not fully accessible to mobile devices. Based on Marcus' (2006) and Nielsen's (1993) guidelines, target users probably disengaged from the Jawi Portal because it was unusable and inaccessible.

In 2007, Marcus could see that "the web is becoming mobile", and that web-browsing capabilities were constantly improving (Marcus, 2007). The Jawi Portal was stylised using an outdated dynamic HTML and little CSS, whereas the ictQatar website utilises the available technologies that Marcus has emphasised for new products and services. The ictQatar design and codes showcase the flexibility and adaptiveness to the available technologies recommended by Marcus (2007) as well as Marcotte (2011). The Jawi

Portal did not utilise any updated design and coding methodology, whereas the ictQatar website has codes that are optimised for different screen layouts.

In my own design prototype, I explored the mobile first design methodology with responsive elements (especially typography and images). The metaphors found in the Jawi Portal, the media as well as layout design of ictQatar website and my own research, were used to design the user-interface of Tirta Nirmaya. The technologies I utilised were HTML5, CSS3, JQuery and some mobile application frameworks.

4.2.3 Marcus' Third Guideline: Metaphors

According to Marcus, "metaphors are essential concepts conveyed through images and words" (Ibid p. 71); Lakoff and Johnson (1980) define metaphors as "the way we think, what we experience, and what we do every day" (p. 3). The Jawi Portal used metaphor to reflect Malay cultural symbolism alongside Malay language in Jawi script throughout the site. Images of people in traditional Malay clothing and the calligraphy accentuate the metaphors of the Jawi Portal (Fig 4.6a).

According to Gallop, "the whole history of the Malay lands and their intercourse with the rest of the world can be traced through the contents of the [golden] letters" (Gallop, 1994, p. 8) The Jawi Portal exhibited traces of the Golden Letters mentioned by Gallop (Fig 4.6b). Similarly, the Jawi Portal displayed Jawi typography in the forms of calligraphy as well as web-safe fonts. The Jawi Portal tried to reflect the essence of Malay cultural heritage through a modern communication platform.

رواج فقعومين فورتل جاوي

...ين كيه-جاوي مولا دأيدركن

Ruangan Pengumuman Portal Jawi

...رايسين بركومفوتر توليسن جاوي اتاو كيه-جاوي كيني مولا دأيدركن كجبتاتان دان اكينسي كراجأن سرتا ببراف فرلوستاكأن اينستيتوسي فڠاجين تيڠكي. سجق دلنهركن فد 27 جانواري لالو، فرايسين ايت تله دتمبه بأيق دڠن مهدياكن دالم فورمت چكرا فادت باڬي ممودهكن ايدرنڽ. فرايسين ايت جوڬ اكن دأيدركن كسموا سكوله دان اينستيتوسي فلاجرن سلأين فارا فمينفين دان فڠاواي كراجأن.

فرايسين ايت تله دلنهركن اوليه منتري كبودايأن، كسنين دان واريثن (KEKKWA)، داتوٗ سري اوتام دوكتور رأيس يتيم سماس فلنهرن كيمفين فمبودايأن توليسن جاوي دفوست داڬڠن دونيا فوترا (PWTC). كيه-جاوي مروفاكن فروجيك فهليديقن دان فمباڠونن توليسن جاوي تربارو يڠ دأوسهاكن كمنترين كبودايأن، كسنين دان واريثن (KEKKWA) دان كمنترين فلاجرن دڠن كرجاسام كوليج اونيۏرسيتي تيكنولوڬي دان فڠوروسن مليسيا (KUTPM). فرايسين كيه-جاوي ممفوڤأي لاڤن كومفونن يأيت فمفروسيس فركاتأن جاوي، دفتر كات جاوي، فنوكر توليسن جاوي، فڠيمبس جاوي، فلاجرن جاوي تاهون 1، فلاجرن جاوي تاهون 2، بوكو چريتا جاوي دان سني خط.

Fig 4.6a

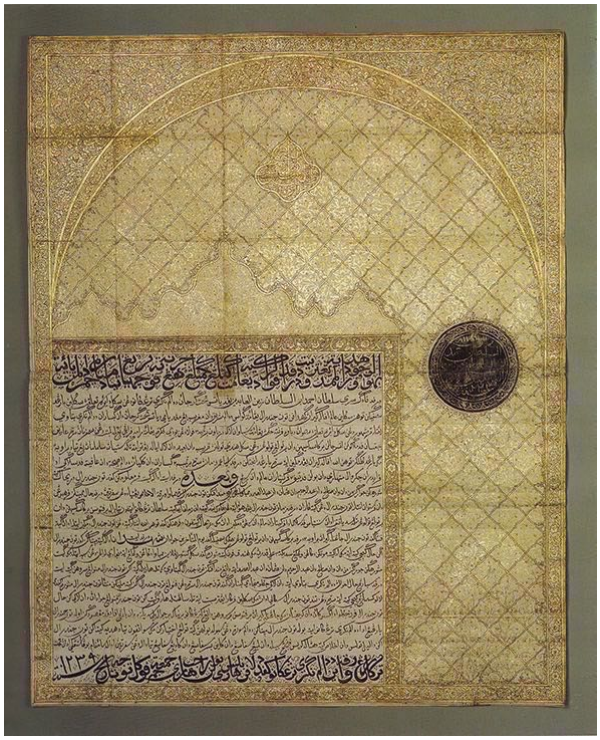


Fig 4.6b A “Golden Letter” from Sultan Ahmad of Terengganu to Baron van der Capellen in Batavia, dated 19 March 1824 (Gallop, 1994, p. 39)

According to Marcus, understanding the user communities is important. Malaysia embraces many cultural heritages. In the post-colonisation period in Malaysia, the cultural heritage of the Malays has become somewhat confused. The Romanisation of the indigenous Jawi typography has become part of the educational and social life of the Malays. As I have previously highlighted by Yaacob (2001), the demise of the Jawi Portal may have occurred because the use of Latin typography in all forms of media, especially in websites, had become so dominant.

Marcus recommends that the verbal and visual content of a website be adjusted with accessible technology to accommodate the target users. The Jawi Portal was able to achieve this by having Jawi font as the text rather than just images. The Google web fonts and W3C standards have made it possible to implement right-to-left languages on the web. Designers should be encouraged to localise the verbal and visual content according to the target user population.

In Chapter 5, I explore how the available technologies can be utilised to localise verbal and visual online content with a globally specific user-interface. The translation of the metaphors in Jawi Portal to the mental model or information architecture were useful for my own project.

4.2.4 Marcus' Fourth Guideline: Mental Models

Marcus states that "mental models are structures or organisations of data, functions, tasks and roles" (Ibid, p. 72). Based on Marcus' explanation of the study made by Hall (1976) and Nisbett et al (2002), the Jawi Portal exhibited holistic thought and low-context communication perceptions of its users. The developers of the Jawi Portal expected its users

to have some experience in reading the Jawi representation of the Malay language, and have experience in viewing a standard web portal.

The Jawi typography reads from right-to-left (RTL) whereas a Romanised typography reads left-to-right (LTR). The structure of the Jawi Portal is a confused mix of RTL and LTR. The main page title starts on the right but the menu links in on the left (Fig 4.7a). In an LTR language, the important elements with high functionality all start from the left (Fig 4.7b), and the reverse is true with an RTL language (Fig 4.7c).

Fig 4.7a The confusing readability of the Jawi Portal

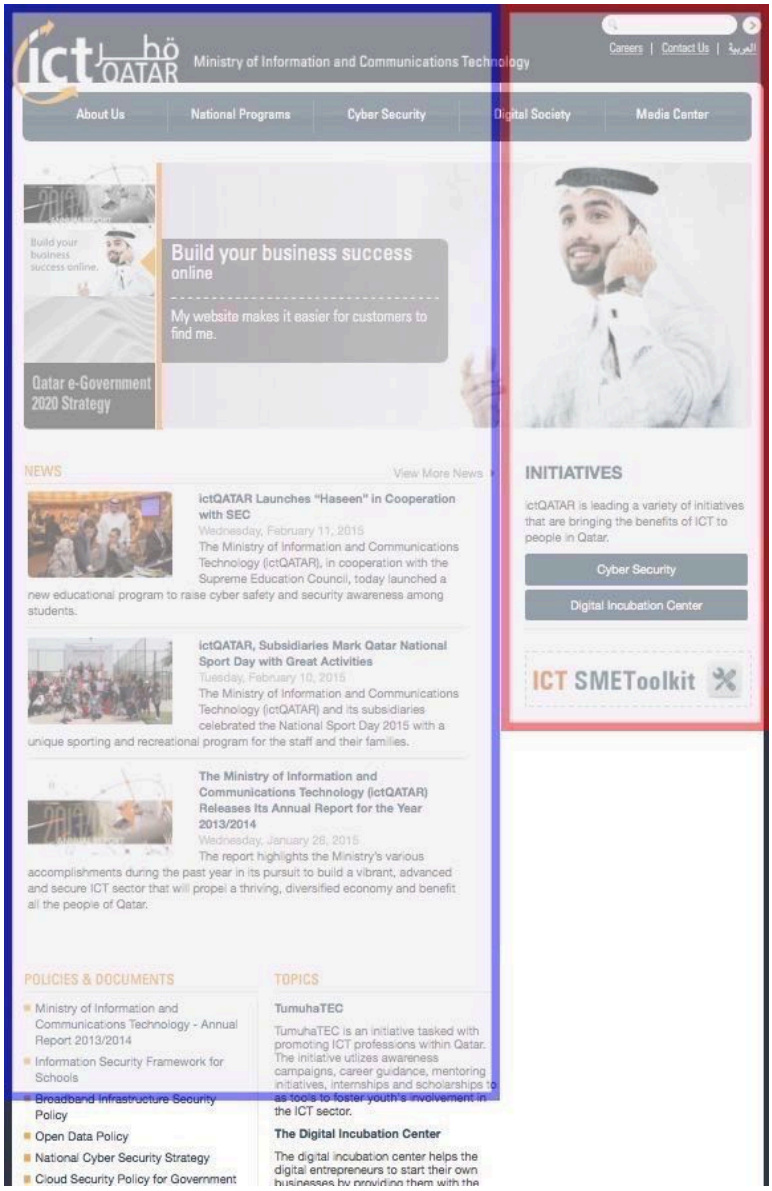


Fig 4.7b ictQatar Romanised English site

Fig 4.7c ictQatar Arabic site

According to Marcus (2005, 2011), mental models are organised tasks and content that users can learn and understand. The Jawi Portal developers may have attempted to cater for experienced users of Romanised interfaces while still maintaining Jawi typography RTL rules and standards. The Jawi Portal seems to be utilising Jakob Nielsen's theory of learnability as a component of usable user-interfaces. The Jawi Portal developers may have organised the Portal's mental model so that users quickly understand the functions of the user-interfaces.

The vertical orientation of the Jawi Portal and ictQatar is consistent with what Marcus (2006) and Callahan (2005) observe in their studies of users in Malaysia. However, Nasrul et al. (2012) indicate that Malay users have a preference for simple metaphors, limited choices and minimal errors in the user activities. The Jawi portal may have reduced the memorability and preferences of Malay users due to the amount of textual data it contains. Although Malay users understand vertical orientation as researched by Nasrul et al. (2012), the high verbal content might have deterred some Malay users from visiting the website.

In Chapter 5, I describe how I formulated a mental model that caters to the preferences of the Malay users more closely. The design example from the Jawi Portal provided a guideline for a more usable interface. The mental model for my project was adapted using the navigation technique proposed by Marcus, Nasrul et al. and Nielsen.

4.2.5 Marcus' Fifth Guideline: Navigation

In describing navigation as a technique of accessing the information architecture, Marcus asserts that the dialogue and process are more important (Marcus 2009). The Jawi Portal may have had a confusing mental model, and that meant the process and dialogue were unclear and inaccessible. The links within the Jawi Portal were inaccessible as there were no clear distinctions between text content and the links, meaning it took longer than necessary to navigate to the other contents of the portal.

According to Marcus and Gould, navigation is supposed to focus on the accessibility of the dynamic rather than the static content. The Jawi Portal contained a collection of dynamic content intended to entice users to explore the portal (Fig. 4.8a). Unfortunately, it may have taken users a long time to identify these links, as could have been mistaken for

headings. The use of typography or text as links is generally acceptable, but the Jawi portal failed to address the design issue of the links (Nielsen, 1993; Reichenstein, 2006).

Fig 4.8a Dynamic content (mouse-over effect) of the Jawi Portal

Nasrul et al. (2012) note that Malay users prefer icon-based menus with text labels. The Jawi Portal did not have icons as menus, and the typography-based links, in my opinion, may have confused users. Marcus and Gould (2012) recommended using methods to prevent users getting lost around the interface. This may be achievable by the symbiotic presence of both icon and typography that I intend to explore in my project.

In Chapter 5, I explore navigation design that helps users get situated (Marcus & Gould, 2012). The design was conceptualised from the findings of Nasrul et al. (2012) and Marcus (2006). My focus was on achieving a highly usable interaction between the target users and the interface.

4.2.6 Marcus' Sixth Guideline: Interaction

Marcus explains that interaction is how the user communicates with the interface and vice versa. In the Jawi Portal, the interaction had minimal user feedback elements; the ability for users to enquire or receive any feedback did not exist. The only input forms available were the login option and the search query (Fig 4.9a). The near-total unavailability of input and output techniques decreased the usability and usefulness of the user-interface.

Marcus (2006) highlights that user experience design demands the interface be efficient, effective and, most importantly, meets the users' needs. The Jawi Portal included a members' login option, but the only difference was that only the name of the user was displayed (Fig 4.9b). The members' option should have given more control to the users, such as pop-up news updates or other content-based notifications as highlighted by Marcus (2006) in his case-study of several middle-eastern based web portal. The lack of control and inefficient interface have reduced the frequency of users' visits to the portal.

Fig 4.9a The user input options that are available on the Jawi Portal

Fig 4.9b Minimal user control in the members' section

Nevertheless, the sensory feedback of the Jawi Portal made it usable. The Jawi Portal had mouse-over tooltips (Fig 4.9c, d, e and f).that transliterated the original Jawi typography into Roman typography. This aspect of the portal increased the usability of the user-interface with what was arguably a very efficient and rapid learning method. It enables users with minimal knowledge or who are unfamiliar with Jawi typography to move around the portal.

Fig 4.9c Mouse-over tool tips

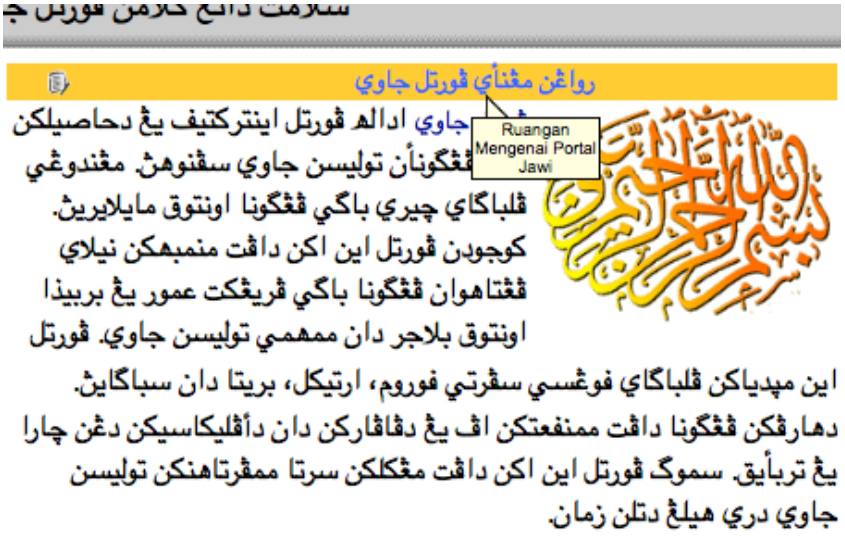


Fig 4.9d Mouse-over tool tips

Fig 4.9e

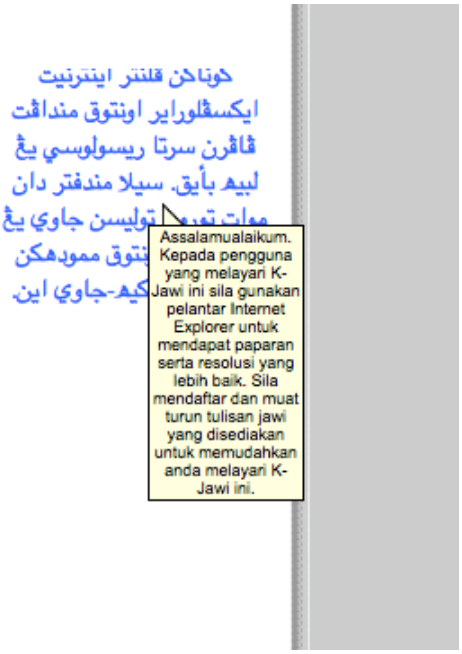


Fig 4.9f Mouse-over tool tips

In Chapter 5, I describe how I designed a useful and accessible means of interaction. The conceptual framework suggested by Marcus, as well as the findings from the case study, were utilised to accommodate Malay users using different platforms. Most importantly, my prototype adhered to Marcus' advice that a user-interface should be usable, useful and appealing. I intend to acknowledge that visual appearance was the key to attracting Malay users.

4.2.7 Marcus' Seventh Guideline: Appearance

According to Marcus, appearance is mostly visual and verbal (Ibid p. 94). The Jawi Portal largely met this guideline on visual appearance. It depicted symbols, typography, colour, aesthetics and language (verbal) style, which indicates that the Jawi portal had the visual appeal needed to attract its target users.

The visual attribute of the Jawi Portal that captured the user's attention initially was the Jawi typography. Displaying Arabic-based typography can be challenging for designers, but the Jawi Portal developers used the appropriate coding, enabling the Jawi font to display properly in all the browsers that I tested. The proper display of the Jawi typography greatly improved the usability and appeal of the portal.

Secondly, the colour scheme of the Jawi Portal complements the typography. Marcus (2007) and Callahan (2005) pointed out that a white background is common in Malaysian websites. The Jawi Portal's minimalist design approach provided the user with a familiar interface experience; this may have encouraged some users to explore the portal more extensively.

Thirdly, the aesthetics of the Jawi Portal – shades of yellowish gold, reflecting the colours of prestige and royalty – indicated quality to Malay users. These aesthetics were subtle yet noticeable, especially through the main header image and links. I acknowledge that Malay users are proud of the prestige found in the Jawi portal, but they could not relate to it based on their daily routine.

Fourthly, the Jawi Portal represented the values and culture of Malay users by presenting the Malay language in the Jawi typography. The verbal styles presented through the heading, body of text, links and symbols increased the Portal's appeal. The main heading

with the government crest and Jawi header was the main source of appeal for the target users.

In the following chapter, I focus primarily on the appeal of user-interface as theorised by Marcus and demonstrated in the Jawi Portal. I explore the possibility of making the Jawi typography into a symbol or icon that is identifiable by Malay users. I also explore other visual and verbal attributes that might suit the current demographics of Malay users.

4.3 Conclusion

To conclude, in this chapter, I analysed the Jawi Portal and ictQatar based on Marcus' specific guidelines on the critical aspects of globalisation in the user-interface design process. I note that the designers of the Jawi Portal showed a clear intention to localise the content with the Jawi script, and likewise ictQatar with Arabic script. The Jawi- and Arabic-based content and links of the pages answer the call of their respective governments to maintain localised cultural context in online content. However, as a normal practice for websites, the overall user experience was not articulated and documented as a reference for designers and academics.

Marcus, in reference to the design process, states that the main objectives for a good user experience are usability, usefulness and appeal. Although both the Jawi Portal and ictQatar manage to engage users, the lack of an interaction and navigation paradigm may have affected the Portal's usability and usefulness. The designers of the Jawi Portal and ictQatar should have documented their processes and made these available to developers designing for user demographics and technology. Thus, the documented processes

identifying usability, usefulness and appeal of the Jawi Portal and ictQatar may provide a clear framework to achieve effective interaction with the portals' content.

Although the Jawi Portal and ictQatar do not adhere strictly to Marcus' specific guidelines on the critical aspects of globalisation for the user-interface design process, the designers have managed to formulate an assumption that a framework for future development of user-interface design based on the Jawi script. The system codes used to present the Jawi script properly were the design highlight of the Jawi Portal. This is important, because the other aspects of user-interface design (icons, colours, layout and aesthetics) can be utilised from Marcus' other globally inclusive guidelines.

In the following chapter, I describe my efforts to value-add and improve on the framework for a user-interface design based on Marcus' guidelines and the findings from my research. I discuss the motivation behind the use of Jawi script and poetry, and show how a documented design process and framework can facilitate designers' approaches to the Jawi-based user-interface.

CHAPTER 5: THE DESIGN PROJECT

How useful or not are the theory and technique observed in this study to the development of my project?

In Chapter 4, I analysed the Jawi Portal and ictQatar to see the extent to which Marcus' globally specific guidelines for user-interface design have been applied. The Jawi Portal and ictQatar show evidence of use of some of the guidelines theorised by Marcus. In this chapter, I describe my process for designing a prototype of the user-interface for the mobile application Tirta Nirmaya, based on the Jawi script. Using the framework and techniques that I have reviewed and analysed, I then study the usefulness of the design framework.

5.1 Tirta Nirmaya: The Manifested Journey of Peace and Love

Tirta Nirmaya was first conceptualised as a teacher-student multimedia installation at Frankston Art Gallery's Cube 37 in 2007. The installation involved my teacher Qais Al Muhib's poetry and calligraphic work and my own digital manipulation of these works. The comments and feedback from the visitors were the motivation to explore the need for a culture-based user-interface at an academic level. Tirta Nirmaya, which means "water without shadows", has since been my motivation to understand Malay cultural heritage in a globalised age.

Tirta Nirmaya was my way of probing further into the complex Malay culture. Sweeney, Al-Attas, Gallop, and Milner point out that poetry and Jawi are key to the Malay cultural identity (Ibid p. 13). The decision to use Qais Al Muhib's poem *Sesuatu Makna Cinta*

as the textual content of Tirta Nirmaya was based on its cultural, religious and spiritual nature. The decision for the overall user-interface design concept was based on Gallop's (1994) documented visual depiction of Jawi as a formal representation of the Malays and the content of the poetry.

5.1.2 The Poet

Qais Al Muhib is the pen name of Sheikh Anuar Al Qadri Al Khalidi. Qais Al Muhib was one of Southeast Asia's most prominent and active Malay Sufi scholars, poets and artists (El Muhammady, 2007). Qais Al Muhib is the direct descendant of the Sufi Master Sheikh Abdul Qadir Al Jailani, and many other scholars of the spiritual as well as human sciences.

Demonstrating spiritual intelligence from a young age, Al Muhib has dedicated his life to attaining spiritual closeness with God, as did the great Sufi masters before him. His poetry and calligraphic works are the fruits of divine inspiration. Under the tutelage of poetry and calligraphy masters, Al Muhib has focused on the spiritual method. Al Muhib's spiritual strength, coupled with his innate artistic talents, helped him master these difficult art forms in just one year; most poets and calligraphers take years to master the techniques and styles of these art forms. Qais al Muhib has also travelled extensively to countries like Turkey, Uzbekistan, Syria, Iran, Australia and the United Kingdom in his quest for mastery of different skills, techniques and styles. Some of his most beautiful works were written and drawn after intense meditation sessions on the remembrance of God (*zikrullah*). Through divine inspiration and guidance, moved by spiritual experience, he has been known to write poetry in complex calligraphic designs with his eyes closed and in one long continuous stroke of the pen.

His calligraphic works show achievement of various shades of the same colour within one stroke or one letter, and even different hues within one letter. This, as great calligraphers acknowledge, is an extremely difficult feat to perform and requires several years of training (Khatibi & Sijelmassi, 1976). Al Muhib has been able to produce magnificent works of art containing this unique feature. The spiritual message that becomes an integral part of each design itself is Al Muhib's way of communicating and connecting with the human experience.

5.1.3 The Poetry

A section of Sheikh Anuar Al Qadri Al Khalidi's poetry, *Sesuatu Makna Cinta*, was used as the textual content of the website for the project. Poetry is considered a tool for social communication in the Malay culture (Asmah, 1995; Goddard, 2003; Sweeney, 1992). Sheikh Anuar Al Qadri Al Khalidi uses poetry as a way of describing and highlighting spiritual and social issues. Below is an excerpt of the poem used in the design prototype (in Jawi and its English translation).

سسواتو معنا چينتا

دڠن نام الله يڠ مها منچيڤتا دان ممبوک باکي لمبرن چيڤتأنث د بيري نام مخلوق دري کران ڤيليهنث سکالا يڠ دي چيڤتا , ديناوڠا دان د لتقکن د باوه نام نام دري صفة صفة ث ار- رحمن (مها ڤموره) ار- رحيم (مها مڠاسيهي دان مها مپايڠي) سأول دري سکالا چيڤتأن ايت , دي تله ممڤرکنن کرونيا ث . دري ڤڠرتين يڠ جلس , دي مپايڠي دان چينتا ترهادڤ سسياڤا يڠ بيسا مڠتاهوءي دان بيسا داڤت ممهمي هيڠک ممباوا ک جنجڠ ڤڠنلن اونتوق مرأيه اتاو منچاڤاي سسواتو يڠ دناماکن حقيقة , تنڤا ميليکي سبوتير نقطه . بيار ڤون ڤڠهوجوڠ , بهاوا دي ميليکي بودي بودي دان صفة صفة کلوهورن يڠ ترڤنوه تنڤا اد منريما ڤربنديڠن دان تنڤا اد يڠ ممڤو منريما تنديڠن . مک اينله مقصود دري توجوان اول ڤمبوکأن لمبرن يڠ دچيڤتا .

The Meaning of Love

In the name of Allah the Utmost Creator and the opener for His creations, which are called creatures from His selections everything that He has created, supported and placed under the names from His Attributes, Ar-Rahman (the Most Gracious), Ar-Rahim (the Most Loving) long before those creations. He has fulfilled his gifts. From that clear understanding, He loves anyone who is able to know and is able to understand till he reaches the point of knowing to attain that which is called hakikat (the ultimate reality), without a single iota. Though it is the end, for He possesses the attributes of purity beyond compare, and there is none that can bear to compare. Thus, this is the meaning from the initial intention of the opening of the creations.

5.1.4 The Project

In my research project, the design prototype of the user-interface contains as yet non-existent typographical font to manage interface presentation of the Jawi script. The presentation includes calligraphic seal-like forms of the Jawi script that represent the logo, title and icons for the links. As Gallop (1994) has pointed out, the calligraphic form of the Jawi script is commonly represented as seals to reflect the rich and prestigious identity of the Malay culture in communicating with their intended audiences. Uda and Al-Ahmadi (1997) have also suggested that the remarkable and historic Malay letters increase the visual appeal of any communication media to current Malays. Therefore, I envisioned that the visual representation of Tirta Nirmaya, which pays homage to historic Malay letters, would provide user-interface designers with a valuable and evolutionary design framework for the Malay user.

The design framework focuses on the arrangement of the Jawi characters into visual forms suitable for a user interface. I prototyped poetry as content and Jawi characters as

the typographical representation of the text and user interface in the mobile application. This is because, in the Malay culture, poetry is a literary genre that is used to narrate history, mythology, proverbs, riddles and folk romances (Al Attas, 1978; Hamid, 1983). Furthermore, Jawi has long been the intellectual and political script of the Malays (Yatim, 2006). My project, Tirta Nirmaya, is an attempt to rekindle the cultural spirit among the Malay mobile users with a representation of poetry and a user interface in Jawi for a mobile application.

5.2 The Malay user interface – A Content and Mobile First Approach

In 2012, there were 13.7 million Malays in Malaysia. The complexity of the Malay culture was demonstrated in previous chapters; designing the user experience can be just as complex. According to Marcus (2006), user experience design includes usability, usefulness and appeal. In my design of Tirta Nirmaya, I hoped to provide users with a consistent, efficient and engaging interface. As such, based on the findings in Chapters 3 and 4, design guidelines were necessary.

Marcotte (2011) and Grudin (2012) both agree that any user-interface design needs to be in context, adaptive and provide an optimal experience. According to Sariyan (2012), upholding Jawi in the modern world requires that it be internalised in software applications. Tirta Nirmaya's user-interface is intended to respond to user needs so that their experience with Jawi script is pleasant and usable. Marcus' guidelines were useful to me in the design of the Tirta Nirmaya user-interface.

The main context of this project was that of Malay mobile phone users in Malaysia. As noted previously, 86.3% of the population are mobile phone users (Statistics, 2012), and

Malaysia leads Southeast Asia, in mobile Internet usage, with a 140% penetration rate (Teller, 2014). Therefore, a mobile first design approach was appropriate for the project.

My main motivation for the mobile first design approach was that most target users use mobile devices. Wroblewski (2012) indicates that mobile first design enables designers to focus on the "constraints inherent in mobile design" and "deliver innovative experiences" (p. 1). The small screens, together with the dwindling use of Jawi script, can be seen as constraints but the experience may have big implications for the users if an adaptive and usable interface exists. Thus, I designed Tirta Nirmaya for users to experience cultural content through hopefully a habitual process.

Tirta Nirmaya also utilises a "content first" design approach – an approach built around the content (Ford, 2014; Knight, 2013; Pamental, 2014). This put the most important and significant element, the typography, at the forefront, equipping Tirta Nirmaya with elements focused on the visual and typographical representation of the Malays. Identifying a visual representation of the Malays, through what Gallop (1998) describes as a cultural marker, is difficult due to the lack of in-depth research on this topic. Academics such as Idris and Mohamad (2013) note that it involves the amalgamation of different aesthetical characteristics (as I discuss briefly in the following section). Therefore, within the limited scope of this research project, I endeavoured to explore the possibilities of a design approach or explorative framework based on Marcus' guidelines.

In Chapter 4, I noted that Marcus leans towards a generalised globalisation process of a user-interface rather than a localised context. Nevertheless, he advises that the localisation process requires user-interface designers to understand his guidelines. Thus, the exploratory design approach of Tirta Nirmaya focused on the typography and composition

of the Jawi script to represent a Malay user interface. In the following sections, I examine issues pertaining to the localised context of the design of Tirta Nirmaya's user interface.

5.2.1 Marcus' First Guideline: User Demographics related to Tirta Nirmaya

Tirta Nirmaya's user interface is designed for Malay users who access the internet using a smartphone and are aware of the place of Jawi script in the Malay language. According to the Malaysian Communications and Multimedia Commission, in the first quarter of 2014, more than 40% of Malaysian internet users were aged 20–29 years, all of whom would have been exposed to Jawi script through the J-QAF programme (ibid, p. 98). The seal-like form and typographical representation at this stage may not be necessary for the user to fully understand it. The targeted Malay users are likely to have sufficient cultural knowledge, language skills and technologically competence to learn the new user interface and layout.

Gallop, Uda et al. and Nasrul et al. indicate that the Malays could relate to visual representations. Gallop (1998) is especially vocal in her praise for Malay aesthetics, especially the intricacy of the Malay seals and the splendour of their illuminations. The intuitive response from the user is the main consideration when designing the user interface and layout. Thus, in Tirta Nirmaya I adopted Gallop's admiration of the Malay aesthetics and featured a floral inspired seal as a logo that I rendered in a 3D perspective for a better visual perspective (Fig 5.1a).

I manually and digitally sketched the visual representation of the logo by combining traditional Malay floral ornaments (Fig 5.1b) and (my interpretation of) cohesive geometrical Islamic patterns with Jawi calligraphy (Fig 5.1c) that are present in the respective cultures. I drew traditional pen and pencil sketches (Fig 5.1d) before making a

more digitally viable sketch for further design enhancement suitable for the internet. The design process involved developing and reconstructing differentiated ideas from various sources, online or otherwise, thus achieving the best visual representation of the Malay culture.

Fig 5.1a Floral inspired logo rendered in 3D

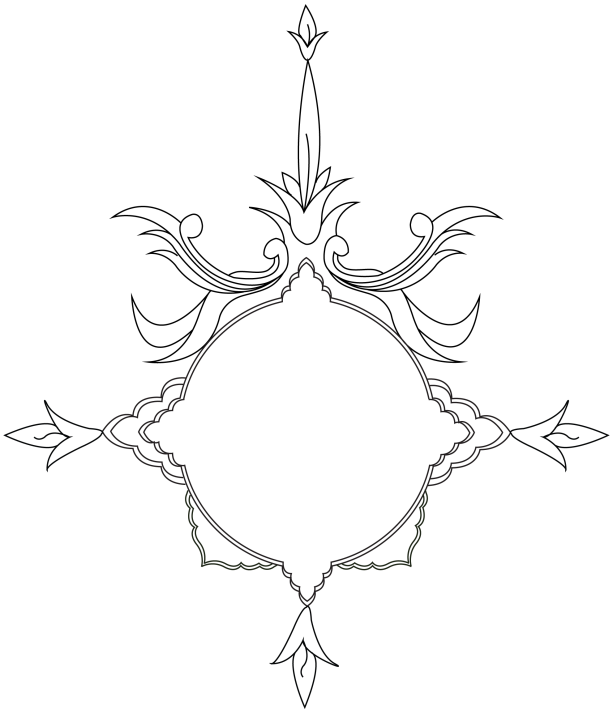


Fig 5.1b My digital sketch of traditional Malay ornaments

Fig 5.1c The digital sketch of an Islamic influenced geometrical pattern and calligraphy

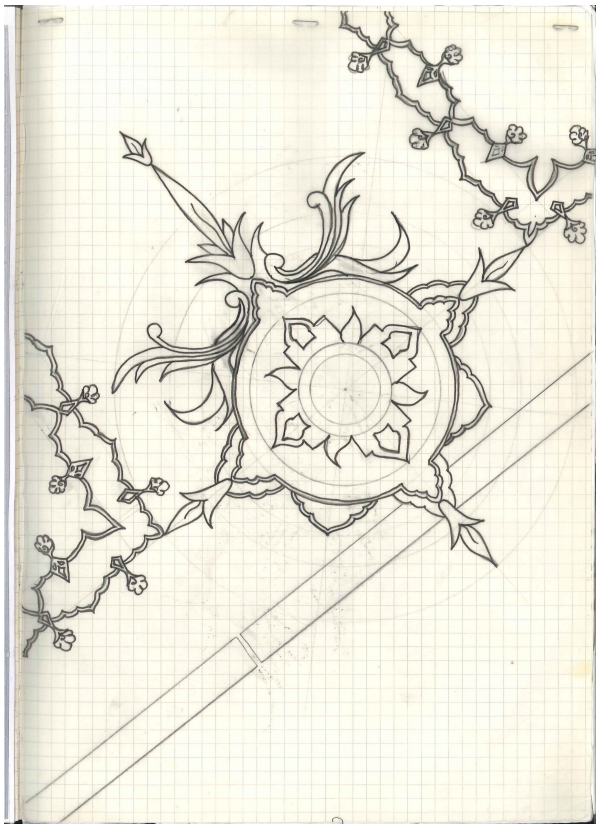


Fig 5.1d The pencil sketch of the idea development process

As is traditional in Islamic and Malay cultures, all seals are geometrical in shape, mostly circular. Gallop (2009) describes many Malay seals written in Arabic or Jawi, circular in shape and featuring a geometric pattern. Marcus and Gould (2012), Barber and Badre (1998), Trompenaars and Hampden-Turner (1998) and Hofstede (1980) have indicated that artefacts and signs are something that describes user demographics. Hence, I chose the geometrically seal-inspired infusion of the main logo as the permanent element that gives Tirta Nirmaya the visual branding of a Malay user interface (Fig 5.1e).

Fig 5.1e The 3D rendering of the geometrical seal-inspired main logo

Although seals are present on every official medium in Malaysia, I based on Gallop's (1994) and Nasrul et al. (2012) researches to include visual representation with which the target user group may be able to identify. Modern street art and the use of Arabic or Jawi script are becoming more popular, as evident from designs by calligraffiti (calligraphy + graffiti) artists such as El Seed (Fig 5.1f) and Jabbari (Fig 5.1g). My design process involved many hand-drawn sketches and reinterpretation (Fig 5.1h) based on traditional and modern calligraphic values. A modern typographical representation was included in the main title, while still maintaining traditional Malay aesthetics (Fig 5.1i).

Fig 5.1f El Seed's Arabic Calligraffiti artwork at Melbourne's Darul Ulum Islamic School. Retrieved from http://elseed-art.com/artwork/

Fig 5.1g Jabbari's Arabic Calligraffiti artwork at Curtin University's Bentley Campus, Perth. Retrieved from http://www.abc.net.au/news/2016-04-14/karim-jabbari's-work-focuses-on-the-art-of-writing.-april-13,/7325992

Fig 5.1h Idea development sketches based on modern and traditional calligraphic values

Fig 5.1i The 3D-rendered calligraffiti-inspired title of the application

In Chapter 4, I noted that the Jawi Portal gave a strict representation of the Malay culture. However, Hooker (2003) notes that modern multicultural Malaysia has assimilated many different cultures. For example, Malays have adopted aspects of Indian culture in their wedding rituals, while the Chinese (Peranakan or Cina Baba) have adopted the Malay language as their mother-tongue (Hooker, 2003). Acknowledgement of the amalgamation of different cultures is essential to accurately reflect a localised approach to the design

process. The Romanised and Jawi typographies provide the assistive and learnable nature of the user interface that is familiar to the local users. To reflect the multicultural identity of Malaysia, Tirta Nirmaya contains some modern Romanised typography, especially in the links (Fig 5.1j).

Fig 5.1j Romanised typography is included to reflect the multicultural local context

A mixture of traditional and modern visual representations can assist target Malay users to identify themselves within a complex cultural and technological environment. When designing Tirta Nirmaya, I undertook a careful analysis of current smartphone and

internet technology. In the following section, I describe how the visual representation of Tirta Nirmaya was mapped against the latest web and application technology.

5.2.2 Marcus' Second Guideline: Technology related to Tirta Nirmaya

The content and mobile first design approach for Tirta Nirmaya was applied from the start of the process. Wroblewski (2012) suggests that the mobile web experience needs to align with users' usage, emphasise content over navigation, be explorable, and maintain a clear focus. Marcus and Gould (2012), Shneiderman (2008) and Marcotte (2011) also agree that users' experience with an interface needs to be appropriate to the available technology. I divided the available technology category into four parts: coding, image, typography and build.

In coding, I planned the design of Tirta Nirmaya using HTML5 and CSS3. Marcotte and Wroblewski both suggest using these web platforms so that designs can be flexible and adaptive to the media that renders them. Lately, the technology has advanced and developers use these platforms for both mobile and web development. With the updated technology, it was more efficient for me to prepare user-interface elements that support multiple devices across different platforms.

In Tirta Nirmaya, the main technical concern was the file format of the images. Designers and developers reduce the size of their design elements to fit the smaller size of mobile device screens; however, smaller images make it difficult to create a usable and useful design for multiple devices. In Tirta Nirmaya, the intricacy of the typography-based images was made flexible, adaptive and responsive by saving them in SVG format.

SVG format enables vector images to scale or adapt to any media that renders. SVG is also recommended by W3C, integrates with other W3C standards and most importantly

does not lose any quality when resized (W3C, 2011). In Tirta Nirmaya, the logos and navigation images are in SVG; this gives the users the same accessibility, clarity and quality in any mobile device.

Typography presented a different set of problems initially. At the beginning of this research, Jawi fonts could not be rendered properly on systems as well as browsers, especially mobile devices. However, in 2010, the W3C and Google Webkit fonts produced standards for right-to-left languages, including Arabic and Jawi, eliminating the rendering problem. As Tirta Nirmaya is designed for HTML5 and CSS3, the rendering of the typographic elements should be perfect. Nevertheless, Tirta Nirmaya's user-interface design needs to be adaptive and flexible for different operating systems and media.

I used several development applications to build the application for different platforms. Intel's XDK HTML5 cross-platform development tool "provides a simplified workflow to enable developers to easily design, debug, build, and deploy HTML5 web and hybrid apps across multiple app stores, and form factor devices" (Intel, 2015: para. 1). Tirta Nirmaya's design workflow involved using Adobe Photoshop and Illustrator for design elements and XDK for building and deployment. These tools allowed the user-interface elements to be actualised from the targeted Malay user metaphorical requirements.

5.2.3 Marcus' Third Guideline: Metaphors related to Tirta Nirmaya

As detailed in previous chapters, Jawi has long been a key component of the complex Malay identity, but its use has declined. How, then, is it possible to represent Jawi script as metaphors that internet users can easily identify? Are users ready for the reintroduction of the Jawi script as a modern digital metaphor that can represent the Malay culture?

In Chapter 3, I pointed out metaphors are images that let users communicate with systems. In chapter 4, I found that the Jawi Portal's use of Jawi script as a metaphor for the links was ineffective, because users were not accustomed to having Jawi as a typographical element or user interface on the web, in contrast to Romanised or modern user interface elements. Therefore, in Tirta Nirmaya, the links I created feature geometrically inspired calligraphy with accompanying Romanised and Jawi text (Fig 5.3a). The calligraphic form is what Gallop (1994) identifies as a cultural marker and has significant characteristics for the target user.

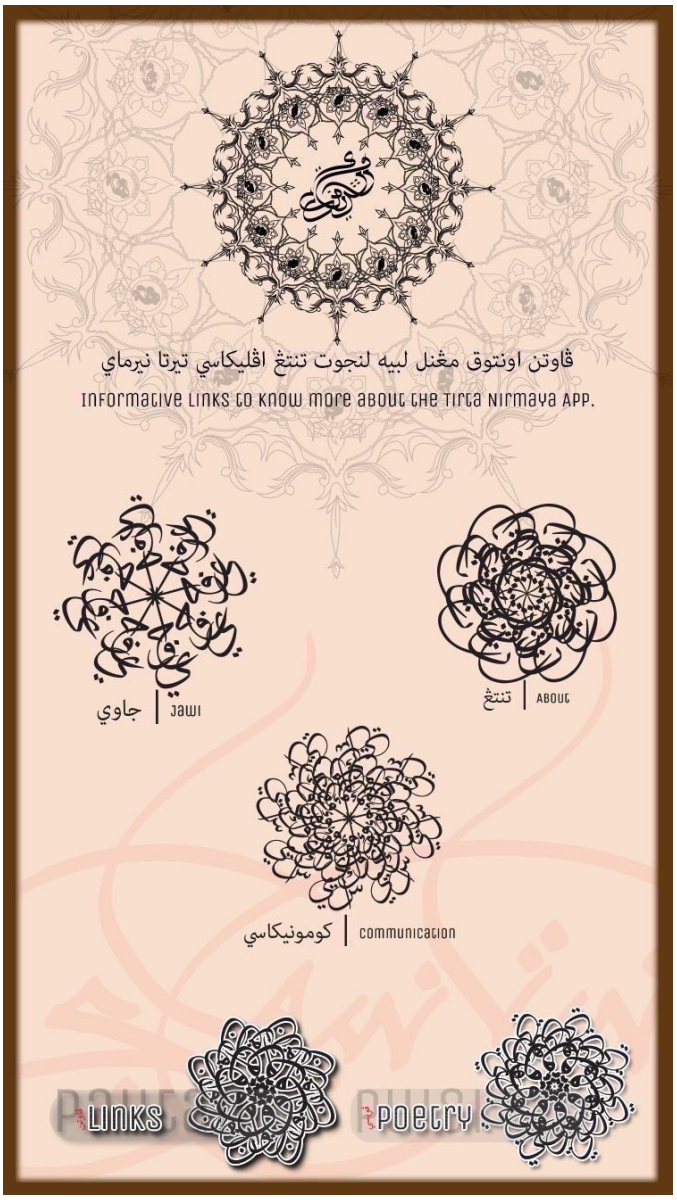


Fig 5.3a

Between the fourteenth and eighteenth centuries, Malay letters and their contents provided a cultural marker for the Malays in their communication with the rest of the world (Gallop, 1998). The letters displayed cultural finesse and artistry that were identifiable as a communication tool (Gallop, 1994). In Tirta Nirmaya, I reinterpreted the composition of the elements, layout and colour scheme mentioned by Gallop (Fig 5.3b). This reinterpretation acknowledges floral (or arabesque) and geometrical forms and was influenced by seals from

the past. Thus, the application, as a whole, can be identified as a communicative metaphor for Malay users.

Fig 5.3b Initial sketches to capture the essence described by Gallop (1994)

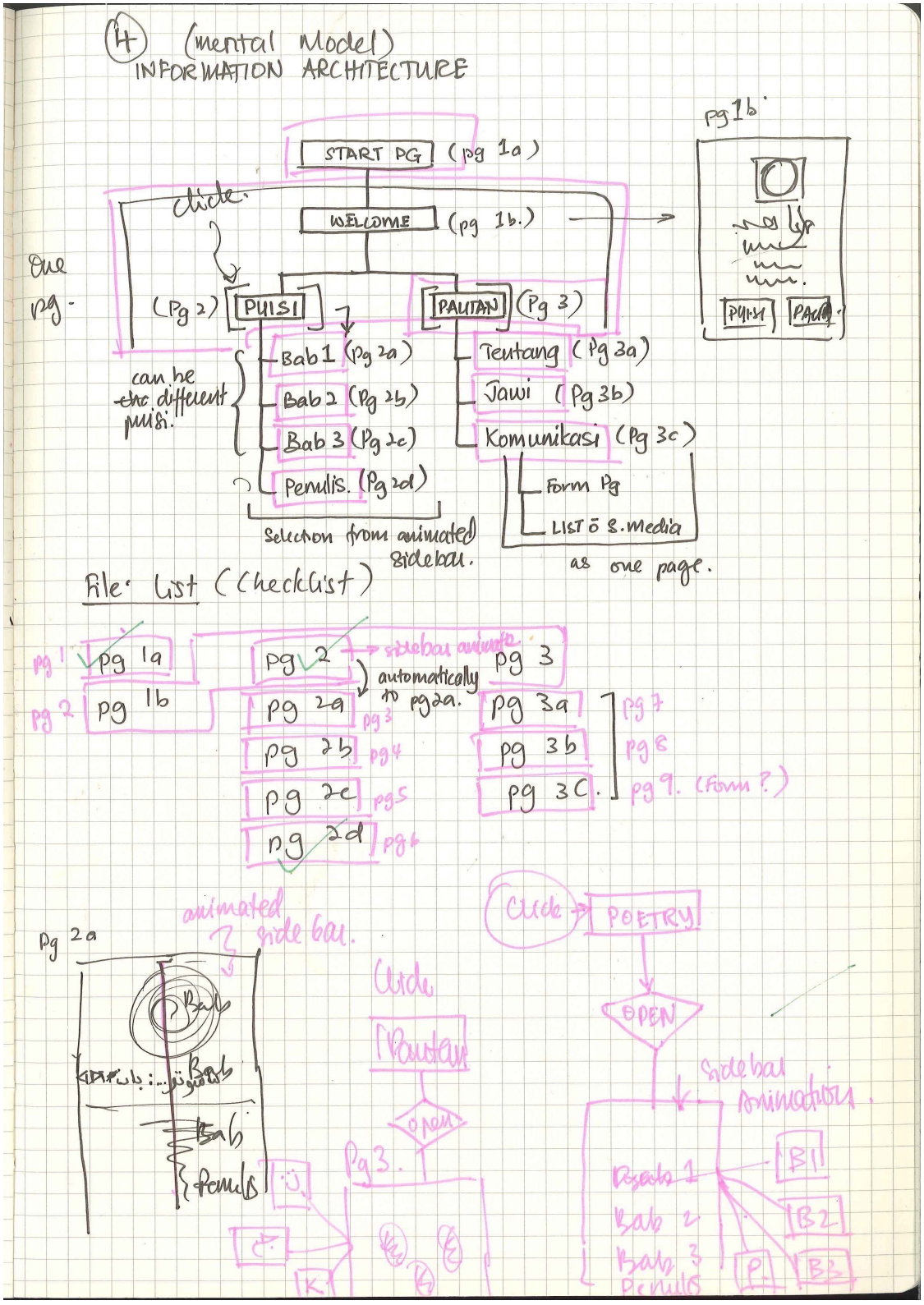
When the application is identified as a metaphor between the users and application, the user-interface may then communicate the content more effectively to the users. I reiterate Marcus' view that a user-interface needs to be methodically and gradually adjusted with available technology, and acknowledge that users must learn and relearn the visual metaphors and representations. The seal-inspired logo, links and user interface in general have visual representations intended to inspire the target users to understand and relate more closely to their own cultural heritage. The elements of the user-interface, together with the layout and content, thus providing a script-based metaphor that users can learn and understand.

5.2.4 Marcus' Fourth Guideline: Mental Models related to Tirta Nirmaya

I intended Tirta Nirmaya's user-interface design to be the launching pad for further research into Jawi script. In Chapters 3 and 4, I noted that it is important that a user-interface is learnable for the target user group. To achieve this in Tirta Nirmaya, the initial organisation of data and information required a careful thought process (Fig 5.4a). The diagram in Fig 5.4a indicates that the available information has to adapt to the users and provide them with a clear and memorable experience based on the technology and current user experience.

The relationship between the content and user-interface needs to be dynamic. Marcus divides the cognitive perspective into the holistic and the analytic. In Chapter 4, it was noted that modern Malay users may apply both aspects of the cognitive perspective. In Tirta Nirmaya, to simplify the cognitive process, I limited the choice of links in contexts to the content of the application: "Poetry" and "Links". This allows the users to navigate

through the application with a greater focus on the value of the content and less so on learning the navigation (Fig 5.4b).



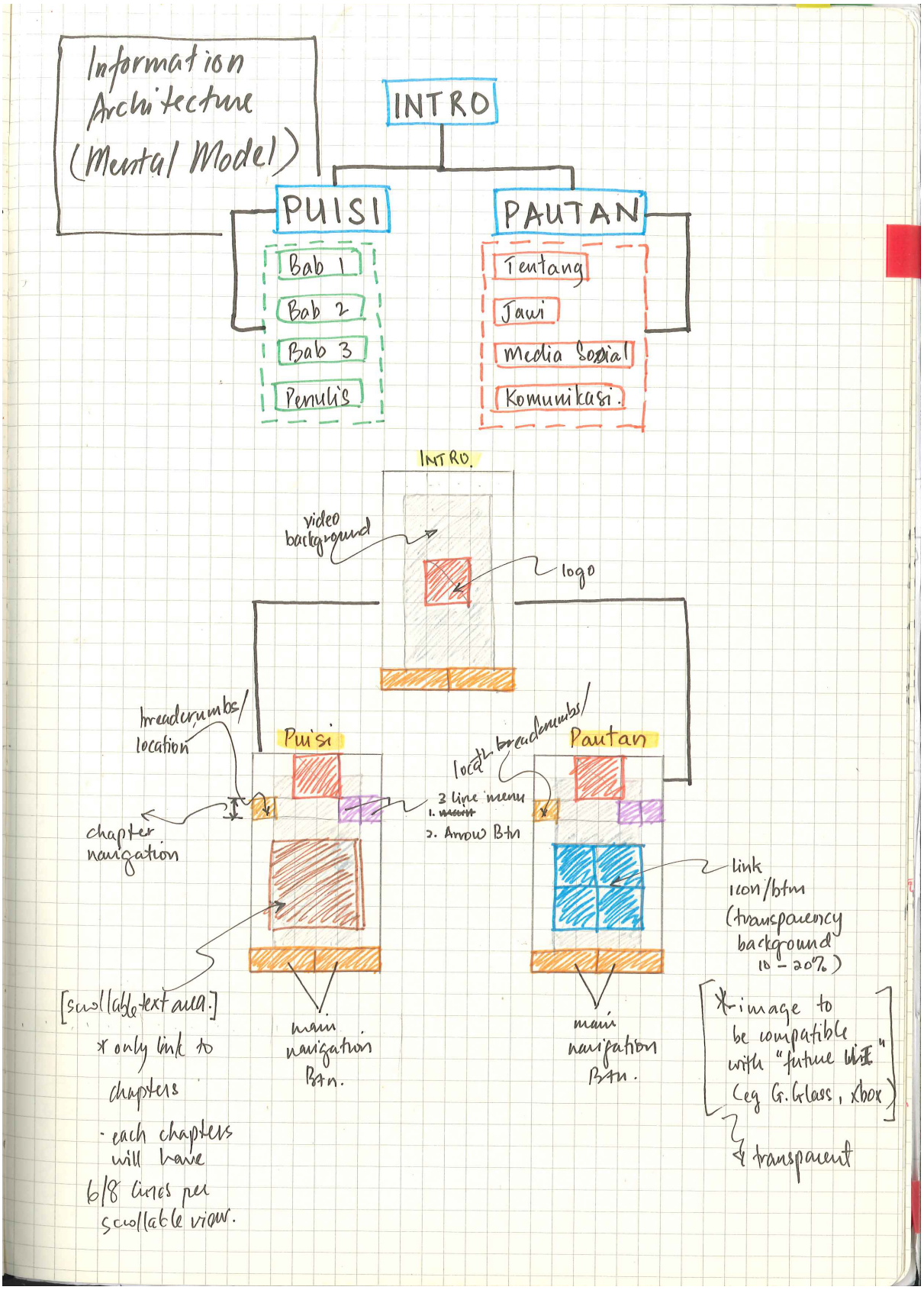


Fig 5.4a Sketched plan of information architecture

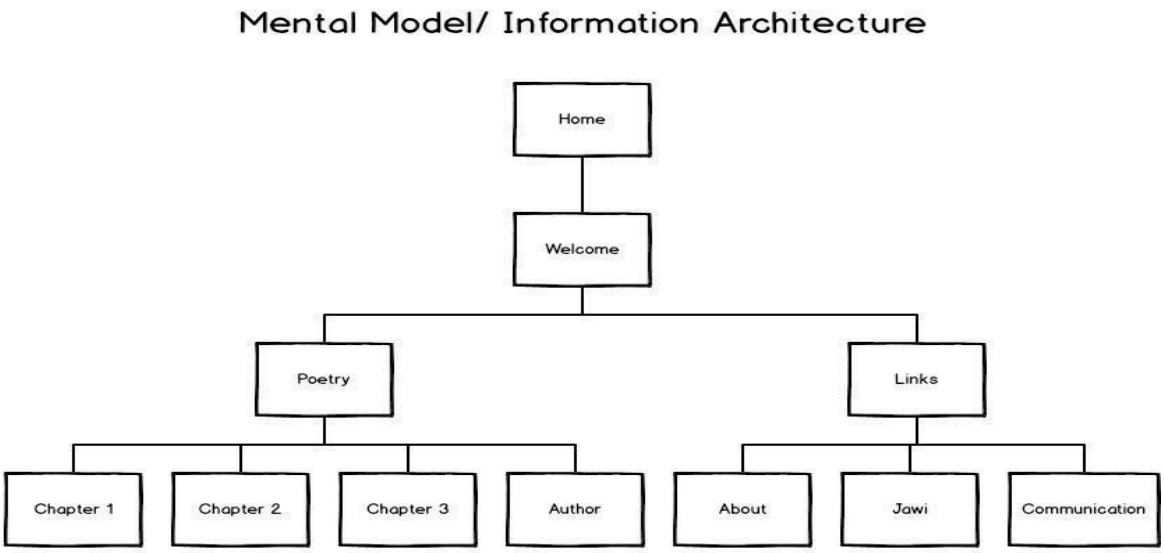


Fig 5.4b Final Mental Model of Information Architecture for Tirta Nirmaya

5.2.5 Marcus' Fifth Guideline: Navigation related to Tirta Nirmaya

Navigation through an application requires an understanding of how users think. Marcus and Gould (2012) state that navigation is a technique to communicate content to the users. With the mobile- and content-first design approach, the mental model and navigation guidelines need to be considered simultaneously. Therefore, the approach can be beneficial as well as content-oriented rather than site-oriented.

The cultural content of Tirta Nirmaya enables the target user to get comfortable with the user-interface. In the Jawi Portal, it was difficult to get from one piece of information to another. In Tirta Nirmaya, the simple and in-context mental model permits users to navigate between sections of the application quickly and easily. The state transition diagram provides designers and developers to become situated (Fig 5.5a).

With the wireframe, it is hoped that the graphical form of the navigation can be clear. The Jawi Portal, made no clear distinction between the textual content and the links; this created confusion for users. The initial wireframe sketch (Fig 5.5b) acknowledges the possibility of a responsive web navigation on any screen. After much sketching and thought, I simplified the navigation process to give users smooth interaction with the content on a mobile screen, as illustrated in the wireframe idea development diagram (Fig 5.5c).

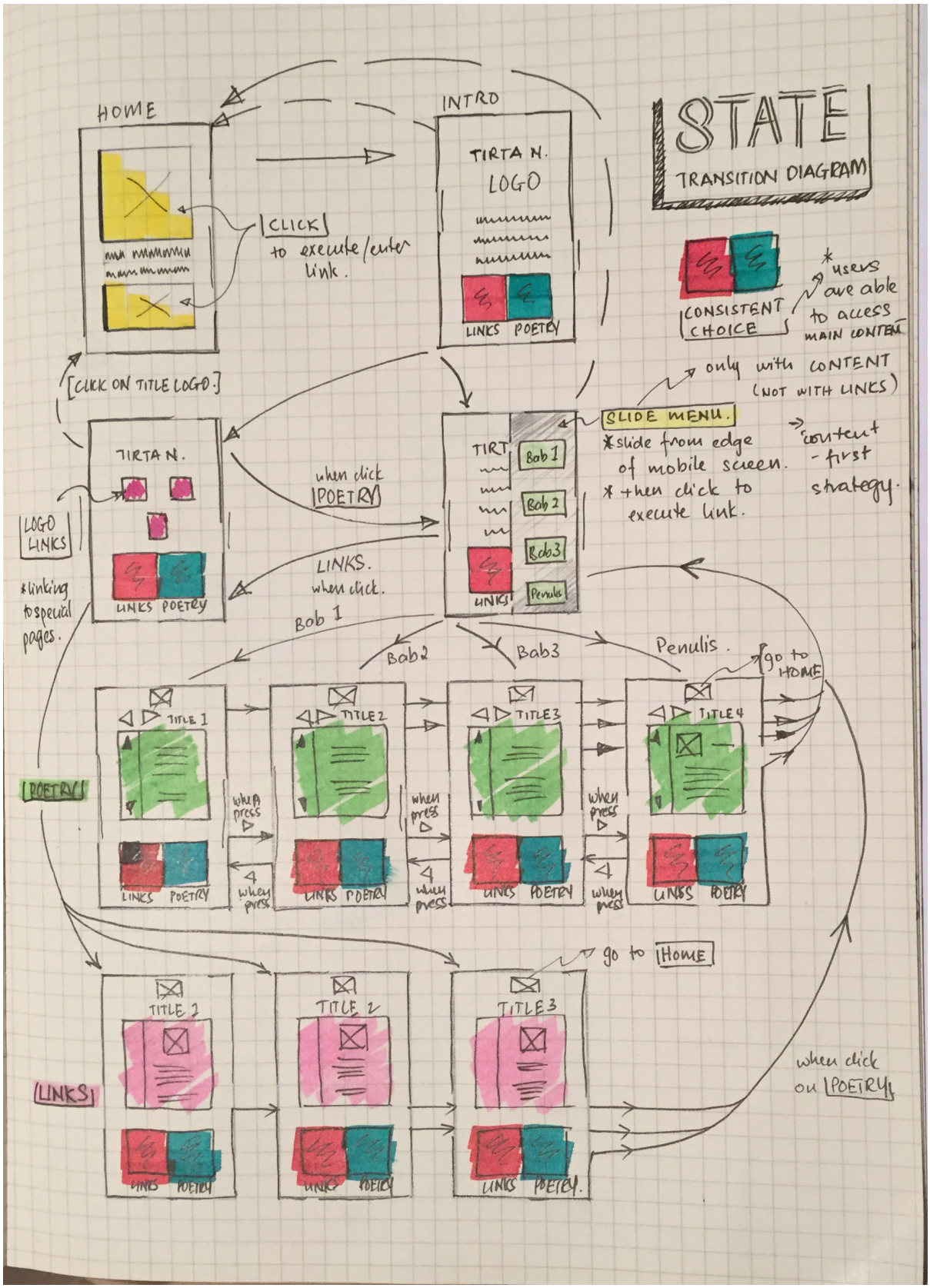


Fig 5.5a State transition diagram sketch

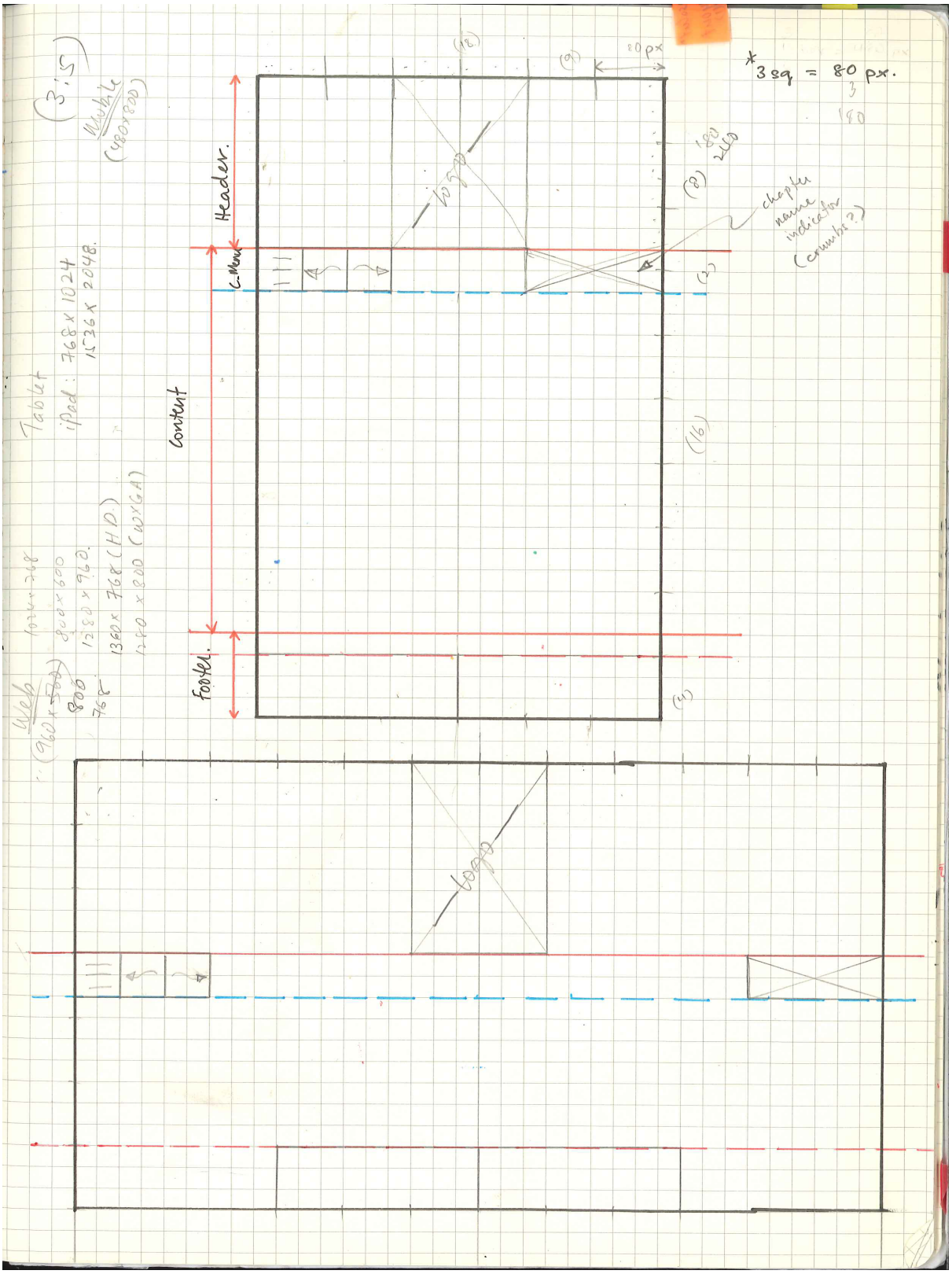


Fig 5.5b Exploring wireframes for responsive web navigation (on any screen)

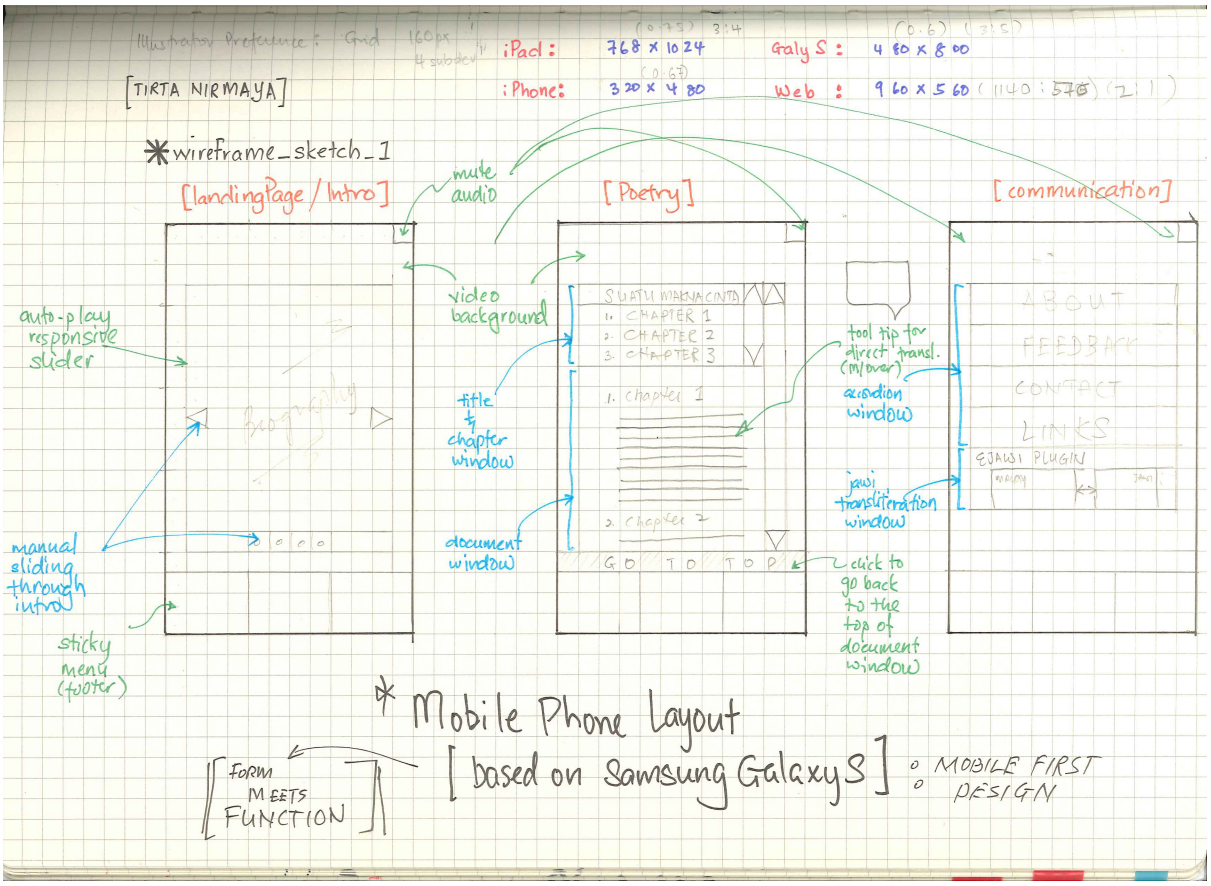


Fig 5.5c A wireframe that makes navigation accessible and clear

5.2.6 Marcus' Sixth Guideline: Interaction related to Tirta Nirmaya

In the mobile first design approach, navigation must be controllable with the hand. Wroblewski (2012) recommends a touch-based user-interface that is appropriately sized and positioned. In Tirta Nirmaya, the links are positioned in a way that enables users to access the elements using their fingers. The accessibility of the user-interface interactivity was first sketched and then finalised as a wireframe mockup to identify processes that are useful and clear for the user (Fig 5.6a).

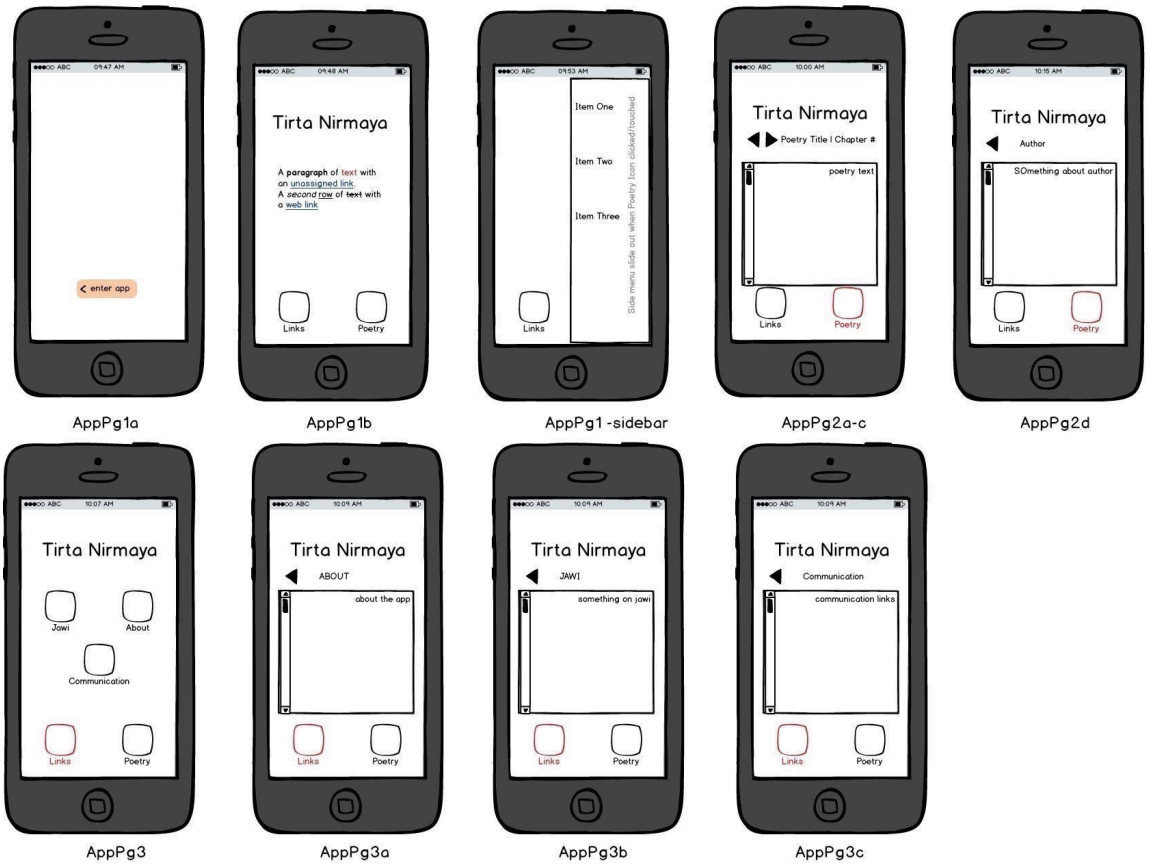


Fig 5.6a Wireframe mockup for Tirta Nirmaya developed using Balsamic Mockups for Desktop

A touch-based user-interface needs to use commands familiar to the users. Many gestures are possible with modern mobile devices. The primary command-control mode for Tirta Nirmaya is finger or touch gestures. Users are only required to touch the menu icons or slide from the sides to access menus (Fig 5.6b).

Fig 5.6b interface with slide menu

Sensory feedback helps the user navigate through the application. Unlike a mouse-based command-control, touch-based controls do not have hover-based interactions (Wroblewski, 2012). I designed Tirta Nirmaya in such a way that the feedback and dialogue are assimilated with the main icon (Fig 5.6c). In this way, the user is instantaneously able to understand the usability and usefulness of the application.

The menu element must be appropriately sized. Marcus and Gould (2012), Shneiderman (2003), Marcotte (2011) and Wroblewski (2012) recommend that media sizes adapt to the overall screen experience. Initially I experienced difficulty in deciding on the appropriate size of the images, as some elements are intricate and have fine lines. The solution was to redesign all elements, making them bigger rather than smaller.

Fig 5.6c one of the menu item

Almost all the elements of Tirta Nirmaya, including images and typographic elements, are bigger than those I usually design for desktop web browsers (as Wroblewski (2012) recommends, "(g)o small by going big"(p. 68)). This enables users to accurately access the information, whether text, images or menu items.

The usability of the application needs to have minimal errors. Human fingers vary in size and are not as precise as a mouse pointer. In Tirta Nirmaya, each element is positioned to prevent accidental touching of another element. The layout of the user-interface will then need to coincide with the wireframe and be appropriately designed.

5.2.7 Marcus' Seventh Guideline: Appearance related to Tirta Nirmaya

In Tirta Nirmaya, the visual and verbal attributes will appeal to the users more than the verbal attributes. This is consistent with Marcus' (2005) assertion that visible

representation is important to a complex culture. Therefore, based on the wireframe, I have tried to replicate the appearance of the Malay letters that Gallop mentions in *The Legacy of the Malay Letters*. The overall aesthetics of the application will then be visually identifiable and appealing to Malay users.

As noted previously, the appearance of the application needs to represent Malay values and culture. The aesthetic theory of Malay culture has five attributes: *berhalus* (exquisite), *berguna* (usefulness), *bersatu* (amalgamation), *berlawan* (contrast) and *berlambang* (symbolism) (Ali, 2006 cited in Idris & Mohamad, 2013). Hence, I designed the user-interfaces to be symbolically useful (*berlambang* and *berguna*) in order to amalgamate (*bersatu*) the exquisite (*berhalus*) Malay culture and the contrasting (*berlambang*) influence of globalisation and available technology. The visual representation is also mapped to the Marcus' guidelines.

The content first approach allowed the typography to be the main focus of the design. The main logo is composed as a seal (emblem) that is highly recognisable in the Malay and Islamic culture. The repeated logo features Jawi script (Fig 5.7a) amalgamated into the floral-inspired calligraphic composition (Fig 5.7b), and this theme is included in all other elements.

Fig 5.7a Tirta Nirmaya in Jawi script amalgamated into the floral composition

Fig 5.7b The floral-inspired composition

The menu icons also add appeal for Malay users. Each menu icon contains Jawi text that directly reflects its function. In the initial stage of typographical design, I attempted at making Romanised calligraphy the ligature of different letters to become a single glyph that will eventually be the icon for the links. After experimentation, I found that the Mufraddat (detached letters) of the Jawi characters makes the icons for the links more identifiable as

Malay cultural aesthetics, and therefore useful and learnable (Fig 5.7c). The design choice for the menu icon aligns itself to the aesthetic theory of the Malay culture – *berguna* (useful) and *berhalus* (exquisite).

Fig 5.7c Exploring Romanised and Jawi calligraphic writing

The Mufraddat approach is very useful in creating a glyph that can be both useful and symbolic (Fig 5.7d). The independent Jawi letters that represent each of the links is geometrically and exquisitely composed into a circular pattern going in an anticlockwise direction. (This directional decision was based on the Islamic practice of circumambulation around the Kaabah in Makkah, Saudi Arabia.) Each menu icon was made useful by amalgamating the Jawi and Romanised text, thus aligning to the aesthetic values of the Malay culture, namely *berhalus* (exquisite), *bersatu* (amalgamate) and *berlambang* (symbolic).

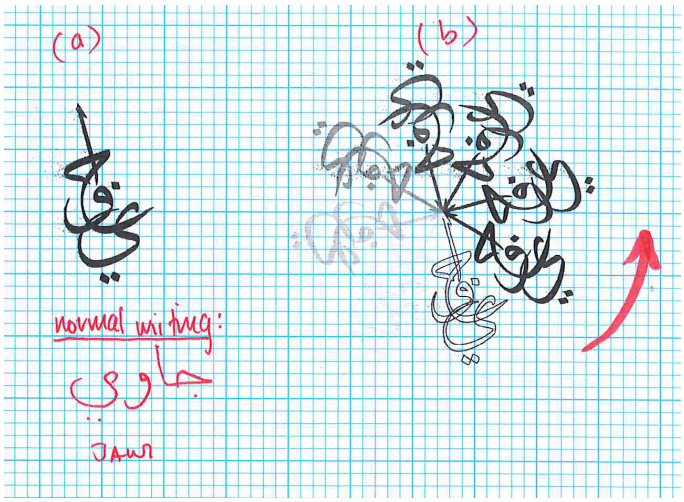


Fig 5.7d Applying the circumambulation of the Kaabah with a Mufraddat approach

The verbal attributes of the application, Tirta Nirmaya are well presented with a full Jawi script to the content. The verbal style is present in the headings, title, body of text, links and symbols. The composition is dictated by the information architecture of the Malay users, allowing the appeal and usefulness of the application to be integrated with other visual attributes such as the colour scheme.

The colour scheme has some contrasting attributes. In chapter 4 I argued that the presence of royal colours in the Jawi Portal may have deterred users from returning to it. Thus, in Tirta Nirmaya, a nature-based monochromatic colour scheme, #f9e1ce – rgb(249, 225, 206), was applied together with common preferences specific to the Malay culture. Jawi script composed in a significant Malay cultural aesthetic – *berlawan* (contrast) – and the monochromatic colour scheme were used to encourage repeated engagement with the application.

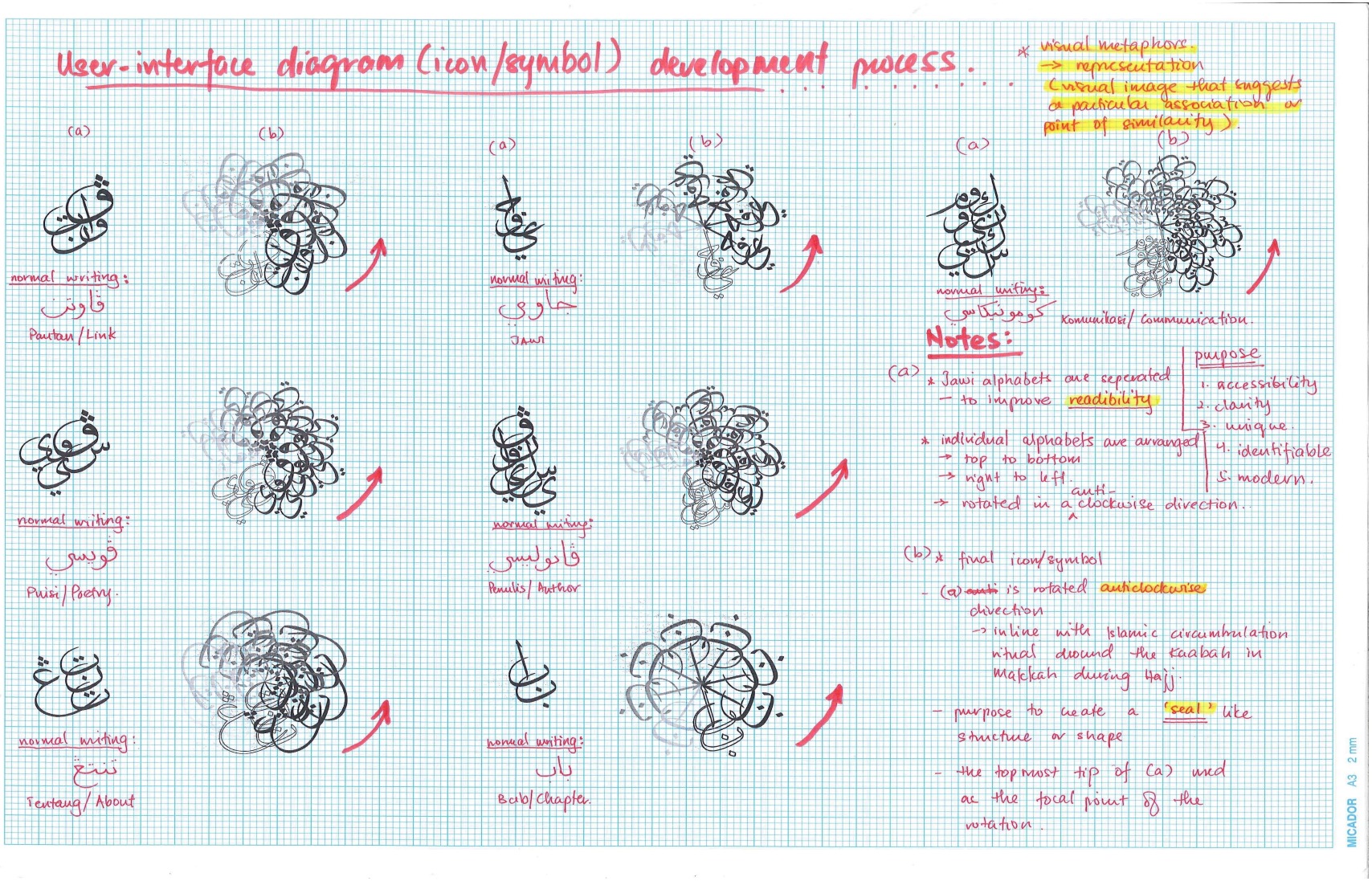


Fig 5.7e User-interface diagram design and justification

The available technology enabled the visual aesthetic of the design to be executed efficiently. The SVG and W3C fonts standards enabled some experimentation with the overall appearance. The application will need future usability testing to understand its accessibility and usefulness, thus providing the possibility of what Munster (2006) terms as novel visual language.

5.3 Implementing Tirta Nirmaya

Marcus' specific guidelines that address the critical aspects of globalisation in the user-interface design process proved useful, a consistent framework for idea generation and techniques. Nevertheless, the consistency of the guidelines requires considerable data on the cultural knowledge of the target group – especially the aesthetic theory of the Malay culture. Therefore, the localisation of the user-interface is dependent not just on cultural knowledge but on Marcus' other guidelines.

The guidelines that Marcus developed are not specific to the internationalisation or localisation of the user-interface. During idea generation for Tirta Nirmaya, I used Marcus' guidelines on user demographics and metaphors to understand the localised needs of the target users. Understanding the local people and the visual language that they identify were the deciding factors for the visual form of Tirta Nirmaya's user-interface (Fig 5.8) The other guidelines, namely technology, mental model, navigation, interaction and appearance, presented a more internationalised approach to the techniques that are required in the design process.

The aesthetic theory of the Malay culture was an important guide for my exploration of the design process and approach. Although little academic literature exists about the aesthetic theory of the Malay culture, it was useful in designing Tirta Nirmaya's user interface – especially the menu icons. A logical progression from this project would be further research and application

of the aesthetic theory in different art forms – digital or not, thus complementing the digital process and traditional art practices that may benefit the Malay users.

Fig 5.8 Tirta Nirmaya design prototype (all screens)

Modern approaches to mobile application development allow the design prototype that I designed to be implemented. The design prototype's user-interface elements, especially the images and typography, can be built using readily available coding. Development tools can facilitate the build process, after which the working application can be implemented and tested with suitable usability testing approaches.

Several platforms allow rapid prototyping and usability testing of design prototypes. Intel's XDK Development tool, UXPin and Adobe XD tool are examples of adding real-time functionality to

the user-interfaces. Each individual element can be easily imported to XDK, UXPin or XD. The algorithmic and object-oriented principles behind XDK, UXPin and XD allow the emulation of Tirta Nirmaya's functionality within the development tool or any supported mobile applications, thus allowing for rapid prototyping and collection of users' feedback.

In the proposed design prototype, usability testing involves Malay users providing constructive feedback to the user-interface designer. Nielsen (1993) and Marcus (2006) agree that usability is all about user preferences and that it is indicative of how efficiently tasks are being executed by users. On the basis of his usability attributes (learnability, efficiency, memorability, errors and satisfaction), Nielsen (1993) recommends that interfaces (specifically icons) be "tested for ease of learning, efficiency of use and subjective satisfaction" (p. 37). To do this, a set of usability testing survey questions can be given to the targeted Malay users.

The desired outcome for this research project was a practical user-interface design framework for designers designing for the Malay user. The user-interface elements that were conceptualised in this research project can be tested for their usability, usefulness and appeal. The design may eventually facilitate more active efforts to garner interest in the sustainable use of the Jawi script, thus providing user-interface designers with an accessible and usable framework to design for the Malay user. Most importantly the outcome may facilitate the design of an as-yet non-existent typographical font to manage interface presentation of the Jawi script.

CHAPTER 6: CONCLUSION

The challenge for this project was to design an as-yet non-existent typographical font to manage interface presentation of the Jawi script. Tirta Nirmaya is the design prototype resulting from my exploration of the techniques necessary for actualizing the interface presentation of the Jawi script. The unavailability of a ready-made design framework specific to Malay users necessitated an exploratory approach. In this research project, the design process revolved around an exploration of theories and techniques related to the user interface based on Aaron Marcus' specific guidelines. The specific focus of my project has been on the translation of the ancient Jawi script into a useable typography for presentation on mobile and other online applications. The outcome of this project is the actualization of a design process that may facilitate other designers to use a typographical font to manage interface presentation of the Jawi script.

The project also has wider implications for the understanding of globalised media, particularly in relation to specialized language and culture groups. The project may have implications for designers who are working with specific language or cultural constraints such as indigenous or special-needs users. Aaron Marcus' specific guidelines relate to the critical aspects of globalisation for the user-interface design process that I explore in my project. These were useful for the design process of a prototype user-interface that presents Malay cultural content. These techniques reflect the uniqueness of the Malay identity through its most valuable yet declining asset, the Jawi script. The following text gives a summary of the major observations from my research project and suggestions for future research and implementation.

In Chapter Two, I critically reviewed available literature and theories on Human Computer Interaction, globalisation and the Malay user. I concluded that Marcus' specific guidelines on the critical aspects of globalisation for the user-interface design process are important in designing a localised user-interface for Malay users. These guidelines are useful for designers who undertake user-interface projects for Malay users or other peoples with a rich traditional culture. I employed Marcus' guidelines as the conceptual framework of my research project.

In Chapter Three, I analysed Marcus' guide for user-interface design for a cultural group with a high mobile internet penetration rate. Marcus helps user-interface designers to focus on the critical aspects of globalisation for the user-interface design process. These guidelines, derived from analysing Hofstede's research data, are indicative of the issues within globalisation, particularly the issue of localisation. Diverse cultural influences and the ever-increasing adoption of mobile technology among Malays illustrate the necessity for Marcus' guidelines.

In Chapters Four and Five, I delved deeper into Marcus' guidelines. I analysed design processes using the case studies – Jawi Portal and ictQatar. Further, I applied Marcus' theory to my research project, Tirta Nirmaya. I found that Marcus' specific guidelines prescribe a generalised globalisation approach that is broadly applicable to interface design among all cultures. Nonetheless, when considering the specifics of a localised user-interface, Marcus' individual guidelines are sometimes irrelevant to the target user. As an example, User Demographic, Metaphor and Appearance are more relevant to the Malay user. Nevertheless, Marcus' non-prescriptive and progressive guidelines can be applied to any target group.

6.1 Reflections on Tirta Nirmaya's design methodology

In Tirta Nirmaya, I digitally reinvented the script and design of Malay seals to reflect the rich and prestigious identity of the Malay culture through computer-generated communication. Marcus' third guideline, Metaphors, informed my use of imagery that is representative of the Malay culture. Barber and Badre (1998) concur that cultural markers are indicative of the design elements that are consistently present within the cultural group. In the context of my research, calligraphic script and geometrically floral composition are cultural markers to which Malay users can relate. The metaphors were given an experimental composition to represent the targeted Malay user.

The experimental composition of the design element and calligraphic script is not totally dependent on Marcus' seventh guideline, Appearance. The visual attributes that Marcus recommends are complemented by the aesthetic theory of the Malay culture. In Tirta Nirmaya, the user-interface is designed to be symbolically useful (*berlambang* and *berguna*) in order to amalgamate (*bersatu*) the exquisite (*berhalus*) Malay culture and the contrasting (*berlambang*) influence of globalisation and available technology. Ali's definitive visual attributes of the Malay culture provided a systematic approach to the replication of Gallop's theories on the aesthetic values of the Malay culture, whilst simultaneously conforming to Marcus' seventh guideline.

In the process of idea generation, while exploring experimental design techniques and the evolutionary prototyping of the user-interface, I found that Marcus' guidelines on User Demographics, Metaphors and Appearance were the most relevant in designing a user-interface for Malay users. Marcus' guidelines on Technology, Mental Model, Navigation and Interaction are not critical factors in designing a user-interface for the Malay user. In the case studies, the appearance of the user-interfaces depended more on the user

demographic and the metaphor (visual and verbal attributes) of the targeted user group.

Due to the globalisation process that Aykin, Nielsen and Marcus identify, it is clear that localised information is important.. From the two case studies, I observe that there are not many case studies to corroborate citations for a more informed and definitive statements to my project. Marcus theory on technology contextually dictates how users navigate and interact through their information architecture (mental model). Most importantly, their cultural nuance and geo-economic situation highlight the importance of the cultural aesthetics of the Malay user. The absence of a strong case study amplifies the importance of my project to localize the user-interface. Thus providing the visual language that is necessary in a sustainable user-interface design process.

As Munster (2006) points out, the computer is able to create novel visual language from digitally produced artwork. The user-interface in Tirta Nirmaya thus attempts to replicate the rich, prestigious and novel visual language of the past for the digital age. The novel visual language of Tirta Nirmaya, based on Marcus' specific guidelin, is representative of the influences on the Malay culture, notably the exquisite floral or geometric composition of the Jawi script and the amalgamated and contrasting aesthetic values of the user interface itself. The identification of a novel visual language in Tirta Nirmaya is consistent with Gallop's theories on the Malay culture, in particular the floral and calligraphic representation of the project's user-interface.

By applying Marcus' first guideline, User Demographics, during the design process, I realised the presumptive requirements of a target group that is au fait with cultural-specific knowledge and language skills. In Tirta Nirmaya, the final floral and calligraphic representation was aesthetically conceptualised based on what the targeted Malay user understands and requires. I propose a refined application of Marcus' guidelines specific to

the Malay user focusing on User Demographics, Metaphors and Appearance.

In order to ensure its sustainability and future research relevance, the Jawi script needs to be popularised across available media and cyberspace. Increasing Tirta Nirmaya's availability online, on social media sites and in application stores would be a step towards achievement of a sustainable and ongoing presence. Even traditional visual representations of Jawi script in the form of digitised paintings, digital sketches and other representation contribute to the profile of Jawi content in different media forms and cyberspace. Eventually, user interface or User Experience researchers and experts need to suggest a usable design framework for Malay user experience designers (and Jawi script enthusiasts) to actively produce sustainable content for Malay users.

Doing this may ensure that the Jawi script remains a valid form of visual identity for the Malay culture while sustaining its presence and use. This will counter what Kellner (2000) describes as "the devastating destruction of local traditions" brought about by globalisation (p. 304). Populating available media and cyberspace with the Jawi script is an effective strategy, justified by Munster's assertion that the recognisable standardisation of images on the web can contribute to its increased presence and familiarity in cyberspace (Munster, 2013). This aspect differentiates my research project from many static ones, turning it into a dynamic intellectual concept that may eventually sustain the use of Jawi script in the context of Malay culture.

The dynamic nature of my research project has enabled me to reflect on a prototype that explores the processes and theories of user-interface design for Malay users. Throughout the years that I have spent on this project, I have observed the adaptability of the Jawi script to available technology and design processes. The traditional calligraphic representation of Jawi script will remain the same, but the differentiated adaption is

inclusive to the design process and available technology. The dynamic and inclusive nature of Jawi script are practical indicators of the truth of Yaacob et al.'s (2001) assertion that technology can be the "enabler" to the "reverence and acceptance" of the Jawi script (p. 4). I also assert, based on Marcus theories on localisation, that we need not just technology but a usable design framework to revive the use of Jawi script in a connected and globalised world, therefore creating a research, learning and application landscape for further development of the prototype.

Version 1 of Tirta Nirmaya (the design prototype) will provide a second version (the application prototype) with sufficient elements to develop and execute a usability test. I believe that continuing this research will have tremendous academic and practical significance for Malay internet users, especially in providing a design framework for the production of accessible Jawi-based content. Most importantly, continuing this research is critical not just for the preservation of Jawi script within Malay culture but a more detailed specification of a Malay user-interface.

6.2 A Proposed Design Framework for a Malay User-interface

Tirta Nirmaya was an exploratory design research project based on Marcus' specific guidelines on the critical aspects of globalisation for the user-interface design process**.** Marcus' guidelines provided a dynamic non-prescriptive framework for the design of Tirta Nirmaya's user-interface elements. Analysis and discussion of two case studies suggested that Marcus' User Demographics, Metaphors and Appearance guidelines provide the most relevant design approach for the Malay user. Most importantly, the data from the aesthetic theory of the Malay culture while exploring Marcus' theory on Appearance may create a pathway for a more detailed specification of a Malay User-interface.

The design process and practicality of the theories that I reviewed enabled me to propose an evolutionary design framework for a Malay User-interface. In general, the design framework for a Malay User-interface requires three important components: Marcus' specific guidelines on the critical aspects of globalisation for the user-interface design process, cultural attributes, and usability (Fig 6.1). The three proposed components need to complement each other to enable the design and commission of a usable application. In this research project, I specifically focused on Marcus' guidelines. The other two components, cultural attributes and usability, were conceptualised during the design of Tirta Nirmaya's user-interface and are further discussed in the section on directions for future research (below).

The identification of Malay ***User Demographics*** is the first step in the design process. The comprehensive list of cultural model that I referenced in Chapter 2, which includes cultural models conceptualised by Hofstede, Trompenaars, and Badre and Barber, is the first reference point. Understandings of the cultural setup, the level of language and media literacy of the targeted Malay user group are beneficial in setting the aesthetic climate of the user-interface, thus enabling a differentiated aesthetic and typographical design process.

Differentiated aesthetics and typography require the designer to identify the ***Metaphor*** that is relevant to the Malay user. In the Jawi Portal and Tirta Nirmaya, designers focused on visual and verbal content, such as Malay cultural symbolism (heritage) and literary attributes, are critical to decision-making in designing the user-interface. Signifiers of visual identity, such as traditional dress, official colours and seals, as well as verbal repositories such as language genre, books and letters, must be consolidated to achieve identifiable cultural markers. Identification of the metaphor is important because it provides

designers with the appropriate approach in the design and visualisation of the aesthetics and typography of the user-interface.

The metacognitive experience while identifying the ***User Demographics*** and ***Metaphor*** allowed for the accurate conceptualisation of the ***Appearance*** needed for the user-interface. John Flavell (1979) encourages "careful, (and) highly conscious thinking" to achieve the high demands of analysing a cultural group (pg. 908). As an example, the amalgamation of symbolic visible representation and contrasting visual attributes will authenticate the usefulness and appeal of the user-interface. Composing the verbal content (texts or script) into an identifiable cultural symbol and providing a contrasting repertoire of modern and traditional visual attributes will allow the Malay user to expedite their understanding of and adaptation to a Malay user-interface. The aesthetic theory of the Malay culture may also contribute to detailed specification of the Malay user-interface design framework.

6.3 Directions for future research

As a stepping-stone to future research, I propose to extend a segment of the design framework for specific application to a malay user interface. The framework of a useful design process guideline for the Malay user requires refined analysis of Marcus' guidelines. as we observed in the discussion of the Jawi Portal and Tirta Nirmaya, particularly for the Malay user, the metacognitive process of identifying User Demographics, Metaphor and Appearance provides relevant guidelines for the design process.

We have observed that Marcus' other guidelines – Technology, Mental Model, Navigation and Interaction – are important too, especially in the case study, Jawi Portal but their applications are generally similar across all cultural groups. The Malay user-interface

framework specifically highlights User Demographics, Metaphor and Appearance as guidelines when designing for the Malay user.

The extended framework may look like this:

***MALAY USER-INTERFACE** = **{Appearance (User Demographics + Metaphors) + Technology [Mental Model (Navigation + Interaction)]}** + Cultural Attributes + Usability*

In the review of literature we noted that Marcus and Gould (2012) believe that Hofstede's data analysis has given user experience researchers "valuable set of data variables". I observe that Marcus' explanation of the cultural models data variables is not exhaustive. The Cultural Attributes within the proposed Malay user-interface design framework strengthen the focus on the relevant attributes necessary for the design process. These cultural attributes directly correlate with the aesthetic theory of the Malay culture: *berhalus* (exquisite), *berguna* (useful), *bersatu* (amalgamate), *berlawan* (contrast) and *berlambang* (symbolic). Further research on the aesthetic theory of the Malay culture will increase our understanding of this novel visual language, providing valuable data for researchers and designers to construct a sustainable and useful design framework for Malay users.

In the proposed Malay User-interface design framework, usability involves the user-interface designers' understanding of the cultural attributes of the Malay user. Nielsen (1993) and Marcus (2006) both agree that usability is all about user preferences and that it is indicative of how efficiently users can execute tasks. In Tirta Nirmaya, due to constricted timeframe and resources, usability testing was not conducted. Therefore, future research should involve usability testing, based on Nielsen's usability attributes (Learnability, Efficiency, Memorability, Errors and Satisfaction).

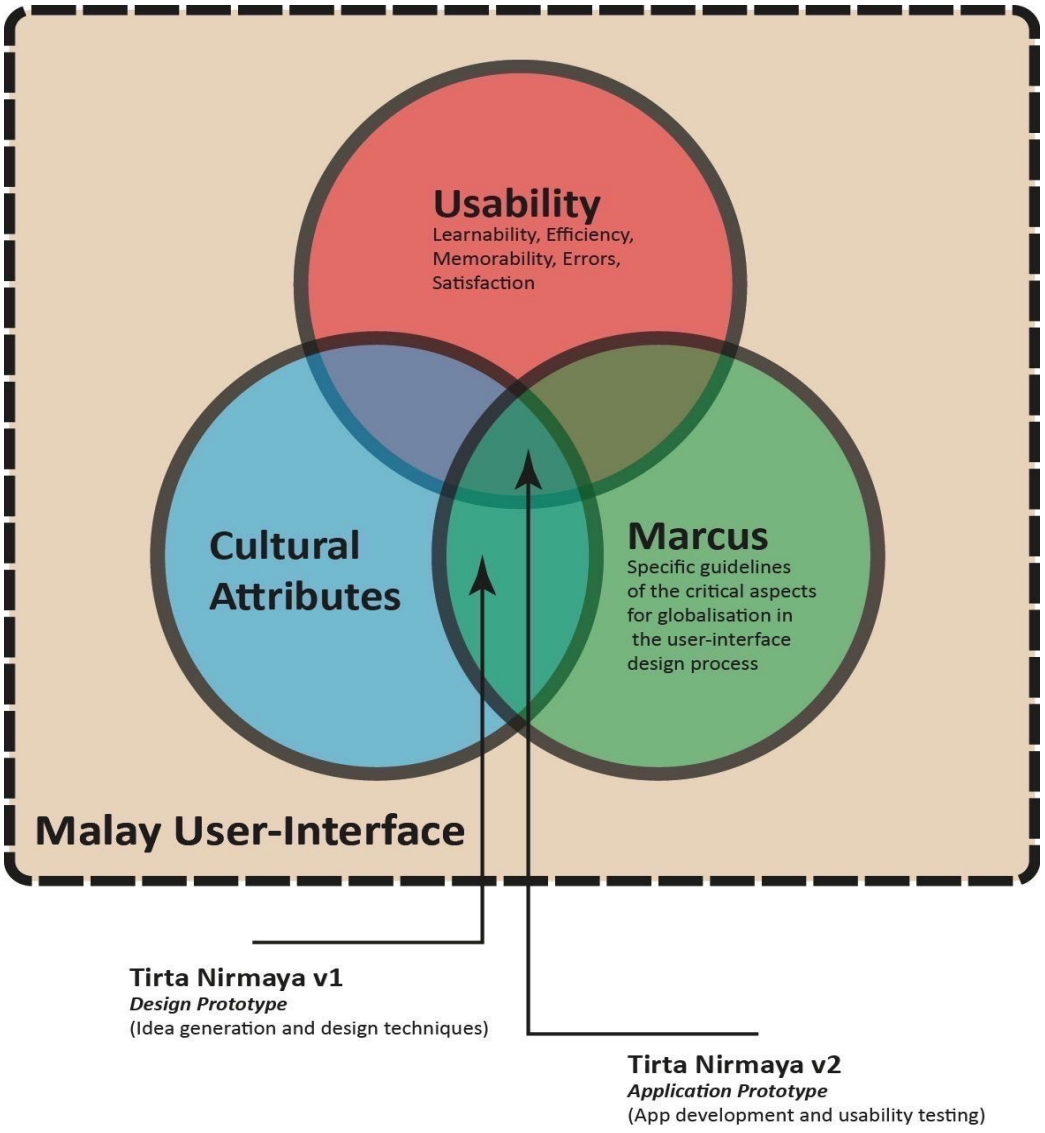


Fig 6.1 The Proposed Malay User-interface Design Framework

Several platforms allow inexpensive usability testing of prototype applications. Intel's XDK Development tool is one example of adding real time functionality to user-interfaces. Individual application elements can be easily imported to XDK. The algorithmic and object-oriented principles behind XDK enable the emulation of Tirta Nirmaya's functionality within the development tool or any supported mobile applications, thus allowing accurate usability testing and user feedback.

Further research could situate the Malay User-interface within the Cyber Islamic Environment (Bunt, 2009). The Malay User-interface is based on Jawi script, an aspect of the

Malay culture heavily infused with Islamic cultural influences. Thus, it may be logical to utilise Bunt's definitive theories on the presence of Muslims in, and their use of, the Internet and situate the Malay User-interface framework. Research could be conducted on several themes within the Cyber Islamic Environment and the wider Islamic community, as detailed below.

Radicalised narratives associated with Islam on social media and the cyberspace are a new and increasingly important phenomenon. Bunt (2003, 2009) acknowledges that the internet is being used as a platform for the propagation of Islam and identity of Muslims, and recommends research into the development of a non-radicalised Islamic identity in cyberspace. The Malay User-interface could provide a framework for the design of the visual and verbal presentation of information in the Cyber Islamic Environment.

The Cyber Islamic Environment contains images and content that depict accurate messages about Islam and the identity of Muslims. Analysis of cultural models within the Islamic community worldwide could provide the necessary Muslim user experience with a distinctive visual and verbal content design strategy. The cultural attributes of the Islamic community could then be amalgamated with Marcus' specific guidelines to produce content that has a positive appeal to Muslims and the wider cyberspace community. The localised Islamic content within the Cyber Islamic Environment could be employed to promote the beauty of the visual and verbal content of Islam to the wider Internet community and beyond, and even produce a localised user-interface specific to the Cyber Islamic Environment.

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APPENDIX A

Jawi alphabets (Daftar Kata Bahasa Melayu Rumi-Sebutan-Jawi, Dewan Bahasa Pustaka, 5th printing, 2006) Retrieved from http://en.wikipedia.org/wiki/Jawi_alphabet

Character	Isolated	Initial	Medial	Final	Sound represented	Rumi equivalent	Name	Unicode
ا	ا			ـا	/a/	a	alif	0627
ب	ب	بـ	ـبـ	ـب	/b/	b	ba	0628
ت	ت	تـ	ـتـ	ـت	/t/	t	ta	062A
ة	ة			ـة	/t/	t	ta marbutah	0629
ث	ث	ثـ	ـثـ	ـث	/θ/	th/ts/s	tsa	062B
ج	ج	جـ	ـجـ	ـج	/d͡ʒ/	j	jim	062C
چ	چ	چـ	ـچـ	ـچ	/t͡ʃ/	ch/c	ca	0686
ح	ح	حـ	ـحـ	ـح	/h/	h	ha	062D
خ	خ	خـ	ـخـ	ـخ	/x/	kh	kha	062E
د	د			ـد	/d/	d	dal	062F
ذ	ذ			ـذ	/z/	z	zal	0630
ر	ر			ـر	/r/	r	ra	0631
ز	ز			ـز	/z/	z	zai	0632
س	س	سـ	ـسـ	ـس	/s/	s	sin	0633
ش	ش	شـ	ـشـ	ـش	/ʃ/	sy	syin	0634
ص	ص	صـ	ـصـ	ـص	/s/	sO/s	sad	0635
ض	ض	ضـ	ـضـ	ـض	/ð/	dh/d	dad	0636
ط	ط	طـ	ـطـ	ـط	/θ/	th/t	tho	0637
ظ	ظ	ظـ	ـظـ	ـظ	/z/	zh/z	zho	0638
ع	ع	عـ	ـعـ	ـع	/ʔ/	a	ain	0639
غ	غ	غـ	ـغـ	ـغ	/ɣ/	gh	ghain	063A
ڠ	ڠ	ڠـ	ـڠـ	ـڠ	/ŋ/	ng	nga	06A0
ف	ف	فـ	ـفـ	ـف	/f/	f	fa	0641
ڤ	ڤ	ڤـ	ـڤـ	ـڤ	/p/	p	pa	06A4
ق	ق	قـ	ـقـ	ـق	/ʔ/ and /q/	q	qaf	0642
ك / ک	كـ / کـ	كـ / کـ	ـكـ / ـکـ	ـك / ـک	/k/	k	kaf	0643 / 06A9
ڬ / ګ	ڬـ / ګـ	ڬـ / ګـ	ـڬـ / ـګـ	ـڬ / ـګ	/g/	g	ga	06AC / 0762

ل	ل	ـل	ـلـ	ـل	/l/	l	lam	0644
م	م	ـم	ـمـ	ـم	/m/	m	mim	0645
ن	ن	ـن	ـنـ	ـن	/n/	n	nun	0646
ڽ	ڽ	ـڽ	ـڽـ	ـڽ	/ɲ/	ny	nya	06BD
و	و			ـو	/w/ and /u, o, ɔ/	w and u, o	wau	0648
ڤ	ڤ			ـڤ	/v/	v	va	06CF
ه	ه	ـه	ـهـ	ـه	/h/	h	ha bulat	0647
ي	ي	ـي	ـيـ	ـي	/j/ and /i, e, ɛ/	y and i, e	ya	064A
ء	ء			ء	/ʔ/	a	hamzah	0621
أ	أ			ـأ	/ʔ, a, u/	a, u	alif with hamzah above	0623
إ	إ			ـإ	/ʔ, i/	i	alif with hamzah below	0625
ئ	ئ	ـئ	ـئـ	ـئ	/ʔ/	-	ye with hamzah above	0626
لا	لا	ـلا		ـلا	/la/	la	lam alif	

APPENDIX B

Table 1 : Malaysia's Cultural Differences Index (Gould et al, 2000)

Cultural Differences	**Malaysia: Ranking**	**Score**
Hofstede (1991, 1997)		
Power Distance	1 (of 53)	104
Individualism	36	26
Masculinity	25/26	50
Uncerstainty Avoidance	46	36
Trompenaars (1998)		
Universalism (Malaysia not ranked for 2 of 3 questions)	9 (of 24)	62
Individualism	22 (of 31)	45
	19 (of 24)	56
	17 (of 29)	42
Specific Relationships	18 (of 33)	72
	9 (of 26)	75
Neutral Communication Style	25 (of 33)	30
Achievement	Unranked	
Time Orientation: Long Term Horizon	35 (of 41)	4.23
Nature Orientation : Mastery	21 (of 29)	26
	Unranked	

APPENDIX C

"Descriptive Statistical Responses of Metaphor/Appearance Images" for Malay users only (Nasrul et al, 2012 ; p. 255)

Metaphor/Appearance Image	**Malay**	
	Mean	**Standard Deviation**
High UAO	4.26	0.74
Low UAO	2.91	0.92
High PD	4.03	1.15
Low PD	2.89	1.11
High LTO	3.6	1.14
Low LTO	3.37	1.06
High MAS	3.17	1.24
Low MAS	3.71	1.2
High IND	3.14	1.12
Low IND	3.83	1.25

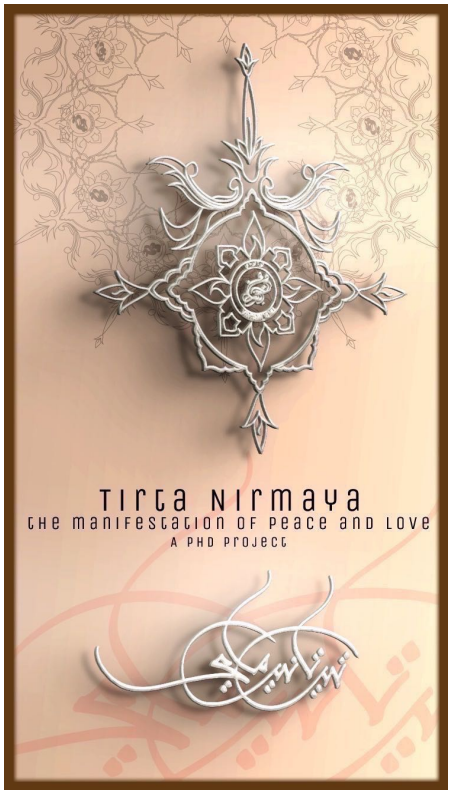
"Descriptive Statistical Responses of Navigation/Mental Model Images" for Malay users only

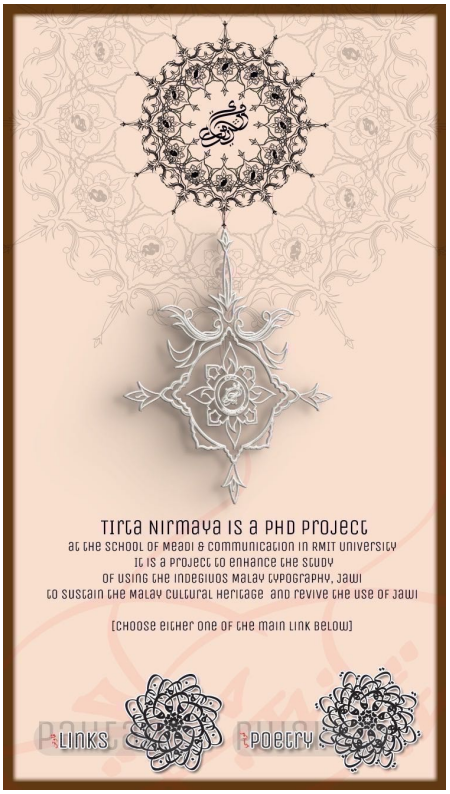
(Nasrul et al, 2012 ; p. 255)

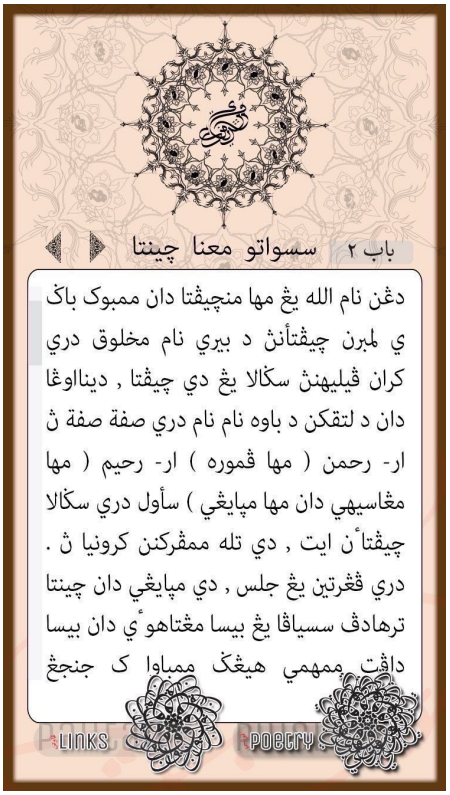
Navigation/Mental Model Image	**Malay**	
	Mean	**Standard Deviation**
High UAO	4.57	0.96
Low UAO	3.23	1.31
High PD	2.71	1.07
Low PD	4.37	0.88
High LTO	4.46	0.87
Low LTO	3.2	0.9
High MAS	3.8	0.5
Low MAS	2.29	0.96
High IND	3.26	1.15
Low IND	3.74	1.15

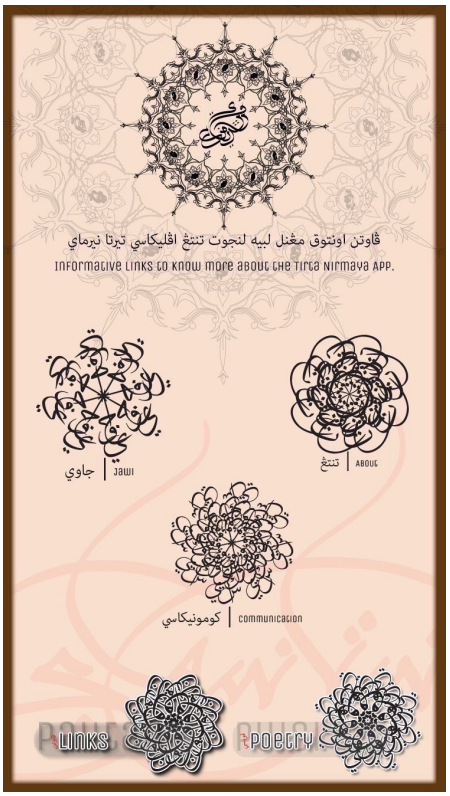
APPENDIX D

Tirta Nirmaya's Design Prototype








ڤاوتن اونتوق مڠنل لبيه لنجوت تنتڠ اڤليكاسي تيرتا نيرماي
Informative Links to know more about the Tirta Nirmaya App.
جاوي | Jawi
تنتڠ | About
كوموڤيكاسي | communication
Links
Poetry


ڤانوليس
قايس الموهيب
دڠن نام الله يڠ مها منچيڤتا دان ممبوک باڬ
ي لمبرن چيڤتأنڽ د بيري نام مخلوق دري
كران ڤيليهنڽ سكالا يڠ دي چيڤتا , ديناوڠا
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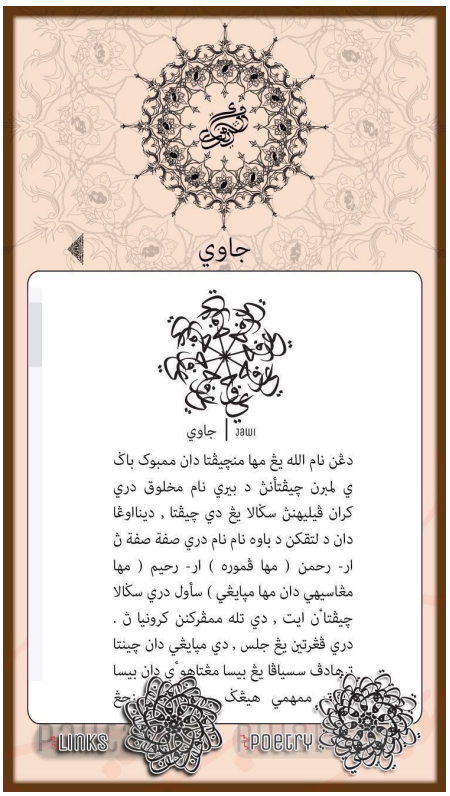
Poetry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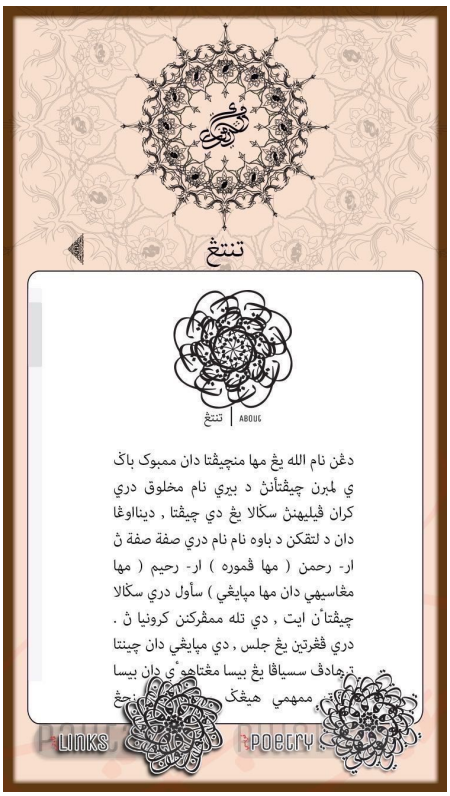
ممهمي هيڠڬ
Links
Poetry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